

# Madsen Creek Flow and Water Quality Control Pond

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## *Operations & Maintenance Manual*

September 2012



**King County**

**Department of Natural Resources and Parks**  
Water and Land Resources Division  
Stormwater Services Section, Capital Services Unit  
201 South Jackson Street, Suite 600  
Seattle, Washington 98104-3855

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## Section I – General Information

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### Purpose of O&M Manual

This Operations and Maintenance Manual (O& M Manual) provides information and guidance for those charged with maintaining and operating the Madsen Creek Flow and Water Quality Control Pond. Proper operation and maintenance of the flow control and water quality facility will ensure this facility will have the desired effect on the Northwest Tributary and West Tributary of Madsen Creek as well as the main stem of Madsen Creek.

### Project Location

The pond is located on property owned by King County but within a 650-foot-wide Bonneville Power Administration right-of-way. The Madsen Creek Flow and Water Quality Control Pond is located at the head of the Northwest Tributary ravine of Madsen Creek, a tributary to the Cedar River.

Madsen Creek Flow and Water Quality Control Pond is approximately 3.3 miles east of the State Route 167 and Interstate 405 Interchange in Renton, Washington in King County.

- Drive 1.7 miles north on Interstate 405 from the interchange.
- Take Exit 4B and go east 2.2 miles on State Route 169 (Maple Valley Highway).
- Turn south at 140<sup>th</sup> Way Southeast and go approximately 0.9 miles.
- Turn left onto an access road with a gate. This is the entrance to the Madsen Creek Flow and Water Quality Control Pond.

### Purpose of Project

The West Tributary and Northwest Tributary of Madsen Creek have suffered damaging effects of flooding and erosion on a regular basis. The pond provides flow control and water quality treatment to mitigate damage to Madsen Creek brought on by urban development prior to regulations that provided for any treatment of stormwater runoff.

The pond will receive stormwater runoff from West Tributary and Northwest Tributary drainage basins, a contributing area of 67.5 acres. The 67.5 acres is comprised of two sub-basins, 19 and 15, as identified in Figure 1.1.1 in the *Madsen Creek – West Basin Water Quality Improvement Engineering Design Report* (King County, February 2005). Runoff from Sub-basin 19 flows into the Northwest Tributary of Madsen Creek. Runoff from Sub-basin 15 currently flows into the West Tributary of Madsen Creek. Flows from Sub-basin 15 are conveyed to the pond through a bypass line.

The pond discharges flow rates equal to those that existed in forested, pre-development conditions of the combined sub-basins and are directed to the Northwest Tributary of Madsen Creek. The facility is one of the key elements identified in the *Cedar River Draft Basin and Nonpoint Pollution Action Plan* to filter pollutants and sediments, stabilize large organic debris and streambed loads, and reduce peak flow conditions within the stream systems.

## **Madsen Creek Flow and Water Quality Control Pond Description**

The flow and water quality control pond is owned and operated by King County Department of Natural Resources and Parks (DNRP) Water and Land Resources Division (WLRD) Stormwater Services Section and under the jurisdiction of the Washington State Department of Ecology Water Resource Program Dam Safety Office (DSO).

The Madsen Creek Flow and Water Quality Control pond is a 4.8 acre facility impounding 27.6-acre-foot at maximum pool depth for detention and water quality. The pond is designed to a Level 2 performance standard as outlined in the 1998 *King County Surface Water Design Manual*. This performance level requires the durations of flows greater than 50 percent of the 2-year flow up to the 50-year flow to be equal to those that existed for pre-development, forested conditions. This standard also maintains the pre-development peak flow rates for the 25-year runoff event.

The pond provides 1.5 feet of dead storage for water quality and incorporates vegetation. The facility consists of two cells, a flow control with overflow system, a conduit system, a filter diaphragm and drain system for seepage control, and a 26-foot-wide emergency spillway.

The pond has a homogeneous earthfill type embankment with an 18-inch thick liner and filter diaphragm and drain system. Along the north perimeter of the pond, the berm height is 13 feet and the crest length and width is 800 feet and 20 feet, respectfully. The facility's control system includes a 96-inch, Type II catch basin with a baffle wall and a bird cage. Two steel plated sluice gates and a steel plate are installed on the concrete baffle wall to provide flow control. The bird cage is the secondary overflow to the baffle wall.

A second 96-inch, Type II catch basin is located on the downstream face of the berm and acts as an energy dissipater prior to flow discharging onto the 9-foot wide, 12-foot long, and 2.5-foot thick gabion pad mattress. The second catch basin was also installed if future construction is needed. Possible future construction would encompass tying into the catch basin with high-density solid wall polyethylene (SWPE) pipe and structures to direct the flows overland if further degradation of the Northwest ravine continues.

The spillway is located on the northeast area of the pond, near the flow control system. It is 20 feet wide and 26 feet in length. It is the tertiary overflow to the birdcage and baffle wall. Additional project information is provided in the Project Data Sheet at the end of this section.

### ***Low-Permeable Liner***

The pond interior bottom and slopes are lined with a mix of on-site-derived glacial till and imported clay or silt. The minimum thickness for the liner during installation was 18 inches. The liner was deemed acceptable by the on-site geotechnical engineering subcontractor (Phase 1; Shannon & Wilson, 2007) and by King County Road Services Division, Materials Laboratory (Phase 2, 2008). No recommendations for regular inspection and maintenance of the liner were suggested. However, inspection was recommended following seismic events: Slumped or cracked material should be regraded and cracks sealed with blended bentonite and soil, or a soil-bentonite slurry or mud (Shannon & Wilson, Geotechnical Report, Madsen Creek Detention Pond, August 2002).

## PROJECT HISTORY

The pond was designed for DNRP Wastewater Treatment Division (WTD) by Willis Mansfield and Rachel Berryessa, P.E., of WLRD Capital Projects Section under the direction of Don Althaus, P.E. in 2004. The pond was constructed in two phases. The first phase was constructed in 2005 by Coluccio Construction Company. The first phase consisted of excavating nearly 21 acre-feet of the pond, constructing the berm with the liner and filter diaphragm and drain, and installing the flow control with overflow system, the conduit system and the emergency spillway.

In 2007, King County Department of Transportation Road Maintenance Services (RMS) began excavating the remaining 7 acre-feet pond and installing the associated liner. In 2008, the work was completed. RMS also constructed the ditch access road and south perimeter road, and installed the sluice gates and plate. The Washington Conservation Corp installed the landscaping plants in the fall of 2008.

## OPERATING AND MAINTENANCE PERSONNEL RESPONSIBILITIES

The facility will be maintained by the King County Department of Natural Resources and Parks, Water and Land Resources Division, Stormwater Services Section. Inquiries regarding the project operation or maintenance can be forwarded to Ken Krank, Supervising Engineer at 206-296-8172. In the event of an emergency, call the King County Stormwater Services Complaint Line at 206-296-1900 or Road Services Division at 206-296-8100.

Overall Responsibility for Project	Curt Crawford, P.E., Section Manager King County WLRD (206) 296 – 8329
Operation at Dam	Ken Krank, P.E., Supervising Engineer WLRD (206) 296 – 8172
Setting Pond Levels and Releases	Ken Krank, P.E., Supervising Engineer WLRD (206) 296 – 8172
Inspections and Monitoring	Ken Krank, P.E., Supervising Engineer WLRD (206) 296 – 8172
Routine Maintenance Work	Ken Krank, P.E., Supervising Engineer WLRD (206) 296 – 8172
Stormwater Services Complaint Line	206-296-1900

## Project Data Sheet

### **General**

State I.D. #:	_____
Owner and Operator:	_____
Location:	_____
Construction Date(s):	_____
Purpose of Project:	_____
Downstream Hazard Classification:	_____

### **Reservoir**

Watershed:	_____
Drainage Area (Acres):	_____
Surface Area at Spillway Crest (Elev. 441.5 ft. NVGD)	_____
Active Storage at Spillway Crest:	_____
Active Storage at Dam Crest: (Elevation: 443.0 ft)	_____

### **Madsen Creek Flow and Water Control Pond Dam**

Type (e.g., earthfill, concrete):	_____
Structural Height:	_____
Design 100-year Water Surface:	_____
Design 100-year reservoir depth:	_____
Design Freeboard above 100-year depth:	_____
Crest Elevation:	_____
Crest Length:	_____
Crest Width:	_____
Upstream Slope:	_____
Downstream Slope:	_____

### **Emergency Spillway**

Type:	_____
Location:	_____
Crest Elevation:	_____
Dimensions of Spillway:	_____
Spillway length:	_____
Discharge Capacity at 0.5 ft:	_____
Discharge Capacity at 1.5 ft:	_____

## **Outlet Works**

Type:	<u>Combined overflow/control structure</u>
Location:	<u>North-eastern side of pond</u>
Controls:	<u>Baffle with notch/two sluice gates</u>
Control structure 36" outlet pipe:	<u>75 cfs</u>
Birdcage overflow elevation (primary):	<u>441.2 ft</u>

## Section II – Project Operation

The primary purpose of the Madsen Creek Flow and Water Quality Control pond is to detain summer low flows in the vegetated portion of the pond in an effort to improve water quality and to regulate storm flows to reduce downstream peak flows. This section provides details of how various elements of the Madsen Creek Flow and Water Quality Control pond are to be operated. Design details are presented in the *Madsen Creek – West Basin Water Quality Improvement Engineering Design Report* (King County, February 2005).

### Operating Instructions of Equipment

This manual provides instructions for operating all mechanisms associated with the Madsen Creek Flow and Water Quality Control pond. There are no inflow controls. Outflow controls are:

#### *Manually Operated Slide Gates*

Two sluice gates are installed in the facility's 96-inch, Type II catch basin located on the upstream side of the berm. This control structure contains a baffle wall and is topped by a bird cage overflow structure. The sluice gates and a plate are installed on the concrete baffle wall. The gates and plate are used to regulate flow and are set at a designated opening height/elevation to release flows as listed above in Table 1. Normal operating conditions are summarized in Table 2.

The sluice gates are manually operated by a non-geared (non-rising stem) handwheel. Clockwise rotations enlarge the opening and counter clockwise rotations will close the opening.

**Table 2 Sluice Gate Operating Parameters**

Parameter	Lower Gate	Upper Gate	Notch
Closed Gate Gauge Position <sup>1</sup>	0	0	n/a
Normal Operation, Opening Height (ft)	0.12' (1.4")	0.50' (6.0")	0.5' (bolted steel plate is 7.2" high <sup>2</sup> )
Normal Operating Gauge Position	1.4	6.0	n/a; 0.5' fixed height

Notes:

1. At gauge position '0', the gates are closed. Gauge positions are graduated in inches.
2. The fixed normal operating notch height is 0.5'. Notch height can only be changed by bolting on a shorter plate. The total notch size without a plate is 1.1' high by 0.5' wide. See Plans in Appendix A.

**Note:** Should a handwheel become difficult to turn, particularly when a gate is near closure, do NOT force the wheel in the close direction. Reverse the wheel to reopen the gate, then attempt to re-close the gate. In no case should the wheel be forced toward the closed position with more than normal effort. Should resistance to closure occur, stop closure of the gate when resistance begins and seek professional assistance.

#### *SLIDE GATES – EMERGENCY OPERATION*

*Emergency operation or opening of the lower sluice gate is required when lowering of the pond's water surface elevation is necessary to relieve hydrostatic pressure on the dam, such as during a potential piping failure of the embankment. The gate should be fully opened and reservoir drained as quickly as possible as Madsen Creek (Northwest Tributary) will allow.*

*Emergency operation of the upper sluice gate is NOT recommended during dangerously high water surface levels. The primary outflow pipe will likely already be flowing at maximum capacity and opening the slide gate will not increase discharge.*

#### ***Plate Attached to Notch***

No operation required (see Table 2).

## Section III –Maintenance

Element	Frequency	Description
<b>Dam Embankment</b>		
Vegetation & Litter Control	Annually	<p>Cut grass at least annually or more frequently to allow visual surveillance of the embankment surfaces. Maximum grass height should not exceed eight inches.</p> <p>Remove small trees and brush. <b>DO NOT REMOVE TREES LARGER THAN SIX INCHES IN DIAMETER WITHOUT ADVICE FROM A PROFESSIONAL ENGINEER.</b></p>
Burrowing Animal Control	Quarterly or as needed	<p>Repair animal burrows by compacting fill into the excavated areas. If the burrowing is extensive, seek the advice of a qualified engineer.</p> <p>Eliminate the burrowing animals to alleviate the problem for the long run.</p>
Crest Roadway & Design Elevation	Annually	<p>Maintain gravel roadways. Regrade eroded areas. Add gravel as needed.</p> <p>Maintain the design elevation of unimproved crest surface by leveling and grading the crest to design specifications. Fill any ruts or minor depressions. Monitor for deterioration or subsidence. See Section V.</p> <p>Inform engineer of any cracks or subsidence in the embankment or emergency spillway.</p>
Upstream Face Protection	Annually	<p>Repair voids in the slopes by adding and compacting appropriate material. Maintain the upstream face by regrading the slope to original grades. If regrading is extensive, seek the advice of a qualified engineer.</p>
Erosion Control on Downstream Face	Annually	<p>Repair erosion gullies by removing loose material and replacing them with compacted fill. Gravel and rock or planted grass should be added as appropriate.</p>

Toe Drain	Annually or during large storms	Toe drain from Station 7+30 to 9+00. Inspect for, and repair, any slumping, erosion, and other visual deformation along toe (see “Erosion Control on Downstream Face”). Report any toe drain discharge to the Supervising Engineer for dam operation.
Seepage	Annually or during large storms	Report any seepage to the Supervising Engineer for dam operation for additional evaluation. Record seepage locations and quantities at the downstream toe, the berm embankment face, the downstream abutment, and downslope of the toe. Inspect for wet and/or soft areas, or other evidence of seepage forming. Record on Data Form in Appendix D.
<b>Pond Liner</b>		
Low Permeable Clay Liner	Annually  Or  Following large storm and seismic events	Where possible, inspect integrity of liner, especially following large storm events and seismic events, including detailed observations of any slumps and cracks.  Liner material that has slumped or cracked should be regraded and cracks sealed. Possible repair strategies include pouring or placing a soil-bentonite slurry or mud in cracks, or sealing compromised areas with soil blended with bentonite or acceptable low permeable materials. Repair should be coordinated with the Supervising Engineer in charge of dam operation and King County Road Maintenance Services, Materials Lab personnel.

Element	Frequency	Description
<b>Flow Control Structure</b>		
96-inch Concrete CB	Annually	<p>Make repairs to surfaces and joints, including:</p> <ul style="list-style-type: none"> <li>• Repairing minor cracks with an adhesive or epoxy injection;</li> <li>• Patching spalled areas with a bonding agent.</li> </ul>
Concrete Baffle Wall	Annually	Make repairs to surfaces and joints. (Refer to above on maintaining concrete features)
Sluice gates	As specified	<p>Test gates for proper operation and leakage (Table 2).</p> <p>Gates are to be maintained according to the manufacturer's instructions. Follow guidelines specified by the manufacturer. Refer to Appendix B.</p>
Steel Plate	Annually	Remove mineral deposits as needed, and restore corroded metal to original condition by welding on new material.
Bird Cage Overflow	Annually	<p>Remove mineral deposits as needed.</p> <p>Make repairs to entrances.</p>

Element	Frequency	Description
<b>Spillway Channel</b>		
Erosion Control	Annually & after floods	Turf Reinforcement Mat (TRM) is to be repaired/replaced in accordance with the specifications in Appendix C. In addition, for acceptable replacement TRM products, refer to Appendix C.  Grass should be added as appropriate to the damaged area to prevent future erosion.
Spillway Channel	Annually	Remove any obstructions or debris from the spillway channel.
Energy Dissipater (Type II Catch Basin)	Annually	Remove visible obstructions.
Gabion Baskets	Annually	Replace rock and repair gabion baskets, which have been vandalized. Reinforce gabion baskets with concrete slurry if wire basket has corroded.
<b>Inlet/Outlet Works</b>		
HDPE Conduits	Annually	Inspect conduit for leakage or other significant problems (see “Seepage”).  Inspect entire conduit interior either manually or via remote control camera as needed. Repair or reline as needed.
Trashrack	Annually & after floods	Remove all debris from trashrack and spillway opening.
96-inch CB	Annually	Refer to previous section on maintaining catch basins.

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## Section IV – Inspection

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King County-maintained facilities that have been identified as having a potential downstream hazard condition sufficient to warrant an Emergency Action Plan will require detailed annual dam safety inspections. See Appendix D for Dam Safety Annual Inspection Forms. The completed annual inspection forms shall be appended to the original Operations and Maintenance Manual kept in the Stormwater Services facility folder. Additionally, RMS will do a pre-storm survey to ensure that all pipes, trashracks, and flow paths are free of debris when a significant storm is expected. The general plan for dam features to be inspected is as follows.

### Inspection Plan

#### Annual

Annual maintenance refers to the scheduled yearly inspection and maintenance.

1. Lawn, vegetation, and litter removal
2. Make Required Changes in Gates
3. Visually Examine Condition of:
  - a) Dam Crest (survey, See Section V)
  - b) Upstream and Downstream Faces
  - c) Spillway Channel
  - d) Outfall Pad and Structures
  - e) Trash Rack
  - f) Security and Safety Devices
4. Check Spillway Channel for Debris
5. Check Foundation Seepage Area (toe drain area, See Section III)
6. Record Pertinent Information on Inspection Forms in Appendix D
7. Check pond inside slopes and bottom for slumps, cracks, or other unusual grade changes to indicate possible failure of pond liner (See Section III)

#### Emergency (See EAP)

Emergency maintenance refers to the inspection and repair required following severe storm events, vandalism, or earthquakes.

1. Perform detailed inspection of all project elements listed in the annual maintenance checklist (See Appendix D).
2. Test operate all gates through a complete cycle.
3. Inspect spillway and outlet energy dissipater.
4. Test operate all backup operating equipment.
5. Survey observed settlement on dam crest (See Section V).
6. Check Observation Well Groundwater Depth.
7. Review and update Emergency Action Plan (EAP).

Any problems or changing conditions noted during the annual inspection should be reported to the Stormwater Services Section. Any needed Work Request Authorizations for this facility will be prepared by the Stormwater Services Section. Maintenance work is typically performed by the Roads Division Special Operations Unit, (206) 296-8100. Copies of completed Inspection Forms are to be inserted in Appendix E. Copies of Work Requests and completed Work Authorizations returned from Roads are to be inserted in Appendix F of the original Operations and Maintenance Manual.

## **Section V – Instrumentation and Monitoring**

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Madsen Creek Flow and Water Quality Control Pond has no instrumentation to monitor discharge or reservoir water levels. However, one observation well to monitor groundwater levels is located on the downstream side of the berm.

### **Crest Elevation/Settlement Monitoring**

On a biennial basis (or following an event that exceeds an elevation of 440.7 feet, i.e. top of the concrete baffle in the control structure), monitor crest elevations for surface settlement. Using an automatic surveying level or total station, take crest elevations using Point No. K.C. GPS RCKC 3930 as a backsight reference. Point 3930 consists of a rebar and cap and is identified by the following coordinates (shown on Drawing C11 of Plans in Appendix A):

Northing = 169943.967; Easting = 1315664.676; Elevation = 443.59 (datum)

Collect elevation measurements along the top of the crest at 50-foot intervals. Extend the measurements at least 150 feet to the northwest of the spillway and 100 feet to the southeast of the spillway (along the embankment centerline). Measurements should also be collected at observed areas of obvious settlement. The elevation of the top of the berm should be approximately 443.00.

Record measurements and settlement locations relative to the spillway (on Settlement/Movement Monitoring data form in Appendix D). Compare results to past surveys and consult the Supervising Engineer in charge of dam operation if the berm crest exhibits a change in local elevation at any monitoring point.

### **Downstream Groundwater Level Monitoring Point**

Observation well B-3 is located at Latitude N47.4592 degrees and Longitude W122.1466833 degrees (corresponding approximate coordinates: Northing = 170275.188, Easting = 1315531.886), approximately 130 feet north-northeast of the flow control/primary overflow structure (see Figures in Appendix G). In the event of vegetation overgrowth, the well point can be located by GPS. The approximate location of an access trail is depicted in Appendix G.

For emergency inspections, using a down-hole electronic water level meter, measure depth to water surface. The top of casing is located at approximately 435 ft. elevation and is about three feet above the ground surface. The well construction log (AFM780) is attached in Appendix G. Record information on Observation Well Data Form in Appendix D and report water levels to the Supervising Engineer in charge of dam operation. High water levels may require a purge (redevelopment to clear the filter pack and screen) and remeasure to evaluate subsurface hydraulic conditions and their relationship to dam water levels and condition of the bottom liner. High groundwater levels do not necessarily indicate an issue with the dam.

## **Section VI – Permits, Permanent Easements, and Agreements**

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Below is a list of permits required and obtained for the construction of the Madsen Pond. A copy of the permits can be found in Appendix H.

- Stormwater General Permit for Construction Activity. Washington State Department of Ecology.
- Clearing and Grading Permit. King County Department of Development and Environmental Services.
- Dam Safety Permit. Washington State Department of Ecology.

A copy of the agreement with the Bonneville Power Administration can be found in Appendix I.

## **Section VII – Updating**

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This O&M Manual should be reviewed and updated annually by Ken Krank, Supervising Engineer, of the King County Department of Natural Resources and Park, Water and Land Resources Division. Elements to be updated include:

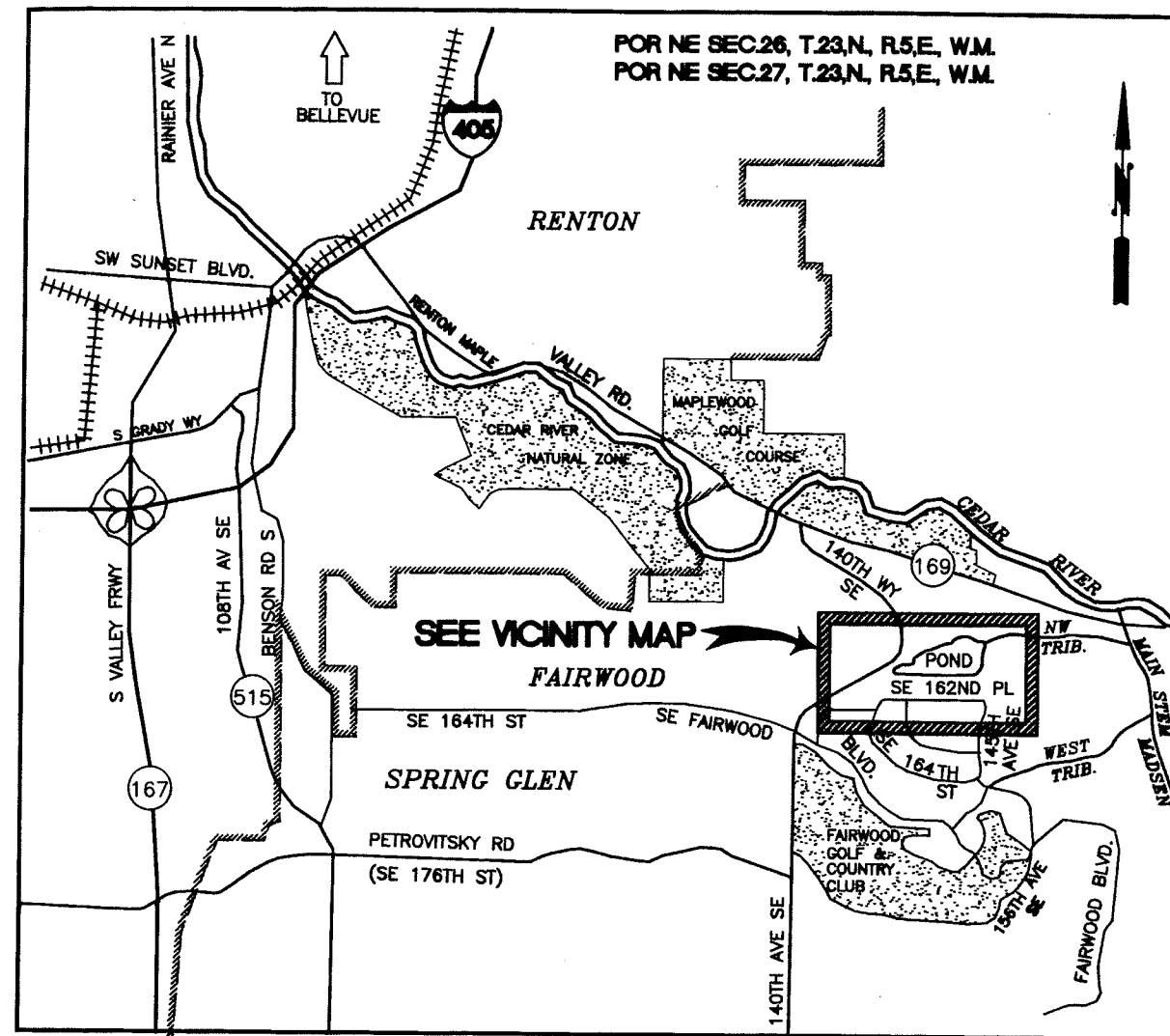
- Names and phone numbers of operating personnel
- Alterations to project data due to changes at the dam
- Changes in operation and/or maintenance procedures
- Increase/decrease the frequency of maintenance routines based on recent performance

Updated information should be distributed to copies of O&M Manual located at:

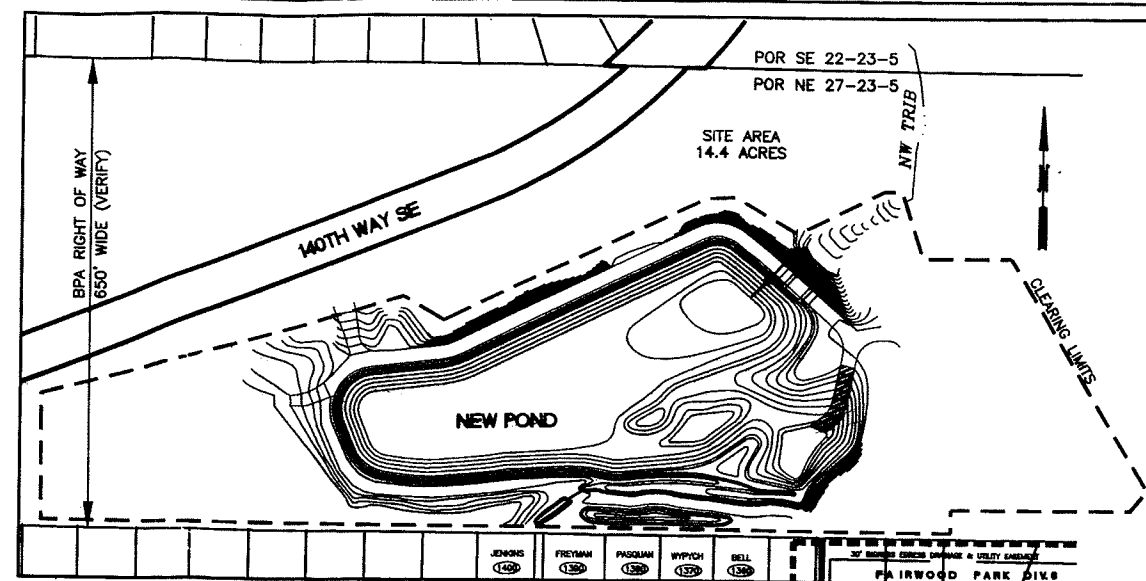
- Dam Site
- Dam tender's personal copy
- Washington State Department of Ecology, Dam Safety Section

## **Appendix A**

### **Project Plans (2005 Record Drawings)**



LOCATION MAP  
NOT TO SCALE



VICINITY MAP  
NOT TO SCALE

### MADSEN CREEK - LEGEND

	EXISTING CATCH BASIN		CONSTRUCTION BASELINE
	NEW CATCH BASIN		NEW POND 1 FT CONTOUR
	EXISTING BPA TOWER		EXISTING 1 FT CONTOUR
	EXISTING PIPE		PROPERTY LINE
	NEW PIPE		ROAD CENTERLINE
	ASPHALT		EDGE OF ASPHALT
	NEW SPILLWAY		EXISTING GRAVEL ROAD
	TYPE C1 OUTWASH MATERIAL		STREAM CENTERLINE
	TYPE C2 GLACIAL TILL		FABRIC SILT FENCE
	FILTER 1 MATERIAL		MULCHING
	FILTER 2 MATERIAL		EXISTING DRAINAGE AND UTILITY EASEMENT
	CONCRETE		RIGHT OF WAY
	CHANNEL RIPRAP		APPROXIMATE GEOLOGIC CONTACT
	CELL 1 ACCESS ROAD		MEDIUM RIVER ROCK
	CRUSHED SURFACING BASE COURSE (CSBC)		

### CALLOUT EXPLANATION

### ABBREVIATIONS

LCPE	LINED CORRUGATED POLYETHYLENE
SWPE	SOLID WALLED HIGH DENSITY POLYETHYLENE
CSBC	CRUSHED SURFACING BASE COURSE
KCRS	KING COUNTY ROAD STANDARDS
SWDM	SURFACE WATER DESIGN MANUAL
TRM	TURF REINFORCEMENT MAT
K.C. GPS	KING COUNTY GPS SURVEY REBAR AND CAP
WTD	KING COUNTY WASTEWATER DIVISION
WLR	KING COUNTY WATER AND LAND RESOURCES DIVISION
BPA	BONNEVILLE POWER ADMINISTRATION

	1 3	TOP IS REFERENCE NUMBER BOTTOM IS THE SHEET NUMBER LOCATION
	1 —	DETAIL 1 ON THIS SHEET
	1 3	DETAIL OR REFERENCE 1 ON SHEET 3
	A 3	SECTION A ON SHEET 3
	A —	SECTION A ON THIS SHEET

### DRAWING NO.

G-	GENERAL
C-	CIVIL
L-	LANDSCAPING

CALL 2 WORKING DAYS  
BEFORE YOU DIG  
1-800-424-5555

APPROVED  
SUBJECT TO  
PERMIT CONDITIONS  
KING COUNTY  
LAND USE SERVICES DIV.  
5/4/05

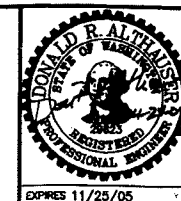
ONE INCH  
AT FULL SIZE IF NOT ONE  
INCH SCALE ACCORDINGLY

### SHEET DWG NO. DESCRIPTION

1	G1	LOCATION MAP, VICINITY MAP, SHEET INDEX, LEGEND AND ABBREVIATIONS
2	C1	EROSION CONTROL PLAN AND NOTES
3	C2	POND GRADING PLAN
4	C3	PARTIAL PLAN AND POND OUTLET PROFILE
5	C4	POND CROSS SECTIONS AND BERM DETAIL
6	C5	SPILLWAY AND BERM SECTIONS AND MISCELLANEOUS DETAILS
7	C6	SPILLWAY TURF REINFORCEMENT MAT AND SPILLWAY CHANNEL DETAILS
8	C7	COMBINED OVERFLOW AND FLOW CONTROL STRUCTURE
9	C8	DEBRIS CAGE DETAILS
10	C9	DRAINAGE STRUCTURE AND OUTFALL DETAILS
11	C10	FILTER DIAPHRAGM DETAILS AND FILTER DRAIN DETAILS AND SPILLWAY TURF REINFORCEMENT MAT INSTALLATION GUIDE
12	C11	CONSTRUCTION STAKING PLAN
13	L1	PLANTING PLAN AND DETAILS (NOT IN CONTRACT)

### DRAWING AND SHEET INDEX

1	FINAL PERMIT REVISIONS	LT.	3/18/05	FIELD BOOK: 1618S/25 06/2000
				SURVEYED: KCDOT 06-2000
				KCDNRP 06-2002
				ESM 06-2004
				SURVEY BASE MAP: LT 09-1999
				CHECKED: TS 09-1999
No.	REVISION	BY	APP'D	DATE



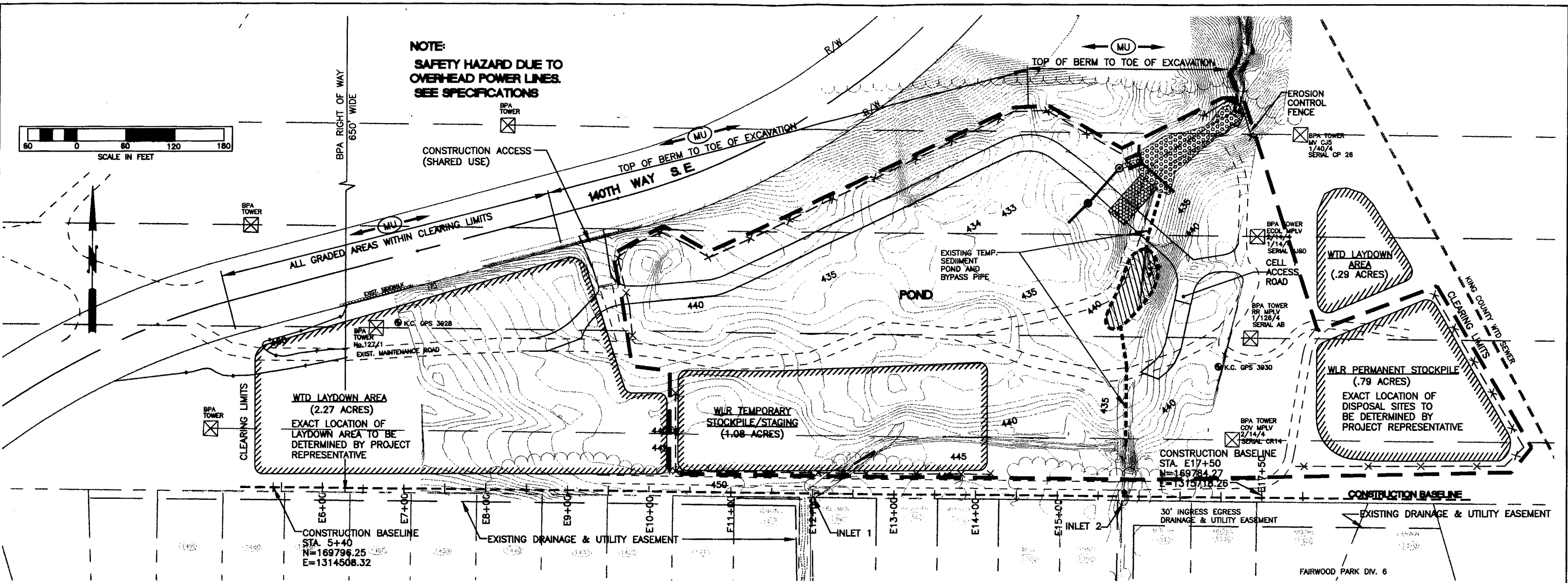
DESIGNED:  
R. BERRYESSA, R.P.E.  
W. MANSFIELD, R.P.E.  
DRAWN:  
L. TRAXINGER  
RECOMMENDED:  
R. BERRYESSA, R.P.E.  
APPROVED:  
D. ALTHAUSER, PE

CHECKED: R.P.  
R. BERRYESSA, P.E.  
SCALE:  
AS NOTED  
CONTRACT NO:  
C53011C



DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
WEST BASIN WATER QUALITY IMPROVEMENT  
LOCATION MAP, VICINITY MAP, AND SHEET INDEX  
LEGEND AND ABBREVIATIONS

MAP-NO. 2003-92  
CNTRL-NO  
DATE:  
APRIL 2005  
FILE NO:  
DRAWING NO:  
G1  
SHEET NO: 1 OF 13



- TEMPORARY EROSION AND SEDIMENTATION CONTROL (TESC) NOTES**
1. The implementation of these TESC plans and the construction, maintenance, replacement, and upgrading of these TESC facilities is the responsibility of the Contractor until all construction is approved.
  2. The boundaries of the clearing limits shown on this plan will be clearly identified by the project engineer by a continuous length of survey tape prior to construction. During the construction period no disturbance beyond the clearing limits shall be permitted. The clearing limits shall be maintained by the Contractor for the duration of construction.
  3. The TESC facilities shown on this plan must be constructed prior to or in conjunction with all clearing and grading so as to ensure that the transport of sediment to surface waters, drainage systems and adjacent properties is minimized.
  4. The TESC facilities shown on this plan are the minimum requirements anticipated for site conditions. During the construction period these TESC facilities shall be upgraded as needed for unexpected storm events and modified to account for changing site conditions (e.g. additional sump pumps, relocation of ditches and silt fences etc.).
  5. The TESC facilities shall be inspected daily by the Contractor and maintained to ensure continued proper functioning. Written records shall be kept of weekly reviews of TESC facilities during wet season (Oct.1-March31) and monthly reviews during the dry season (April1-Sept.30).
  6. Any areas of exposed soils, including roadway embankments, that will not be disturbed for two days during the wet season or seven days during the dry season shall be immediately stabilized with the approved TESC methods (e.g. seeding, mulching, plastic covering etc.).
  7. Any area needing TESC measures, not requiring immediate attention, shall be addressed within fifteen (15) days.
  8. The TESC facilities on inactive sites shall be inspected and maintained a minimum of once a month or 48 hours following a storm event.
  9. The clearing operation shall not flush sediment-laden water into the downstream system.
  10. Stabilized construction entrances and roads shall be installed at the beginning of construction and maintained for the duration of the project. Additional measures, such as wash pads may be required to ensure that all paved areas are kept clean for the duration of the project.
  11. Where straw mulch for temporary erosion control is required, it shall be applied at a minimum thickness of 3 inches.

- TESC CONSTRUCTION SEQUENCE**
1. Pre-construction meeting. Safety meeting with BPA regarding overhead powerlines.
  2. Flag or fence clearing limits.
  3. Post sign with name and phone number of the Public Relations Contact.
  4. Grade and install construction entrance(s).
  5. Install perimeter protection (silt fence, brush barrier, etc.).
  6. Relocate existing construction stormwater bypass out of work area and divert flow into system with a sandbag dam. Construct ditch between inlet 1 and inlet 2. Put flow into storm water bypass pipe.
  7. Grade and stabilize construction roads.
  8. Construct surface water controls (interceptor dikes, pipe slope drains, etc.) simultaneously with clearing and grading for project development.
  9. Maintain erosion control measure in accordance with King County standards and manufacturer's recommendations.
  10. Relocate erosion control measures or install new measures so that as site conditions change the erosion and sediment control is in accordance with the King County TESC minimum requirements.
  11. Cover all areas that will be unworked for more than seven days during the dry season or two days during the wet season with straw, wood fiber mulch, compost, plastic sheeting or equivalent.
  12. Stabilize all areas that reach final grade within seven days.
  13. Seed or sod any areas to remain unworked for more than 30 days.
  14. Upon completion of project, all disturbed areas must be stabilized and highly erosive areas removed if appropriate.
  15. Permanent restoration planting will be done by others.

**LEGEND: TEMPORARY SEDIMENT CONTROL**

MULCH REF. (D-6)

EROSION CONTROL FENCE REF. (D-15)

EXISTING TEMPORARY SEDIMENT POND AND BYPASS PIPE (TO BE REMOVED)

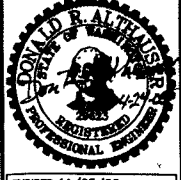
CHANNEL RIPRAP

SPILLWAY

REFERENCE PAGE REFERS TO EROSION AND SEDIMENT CONTROL STANDARDS APPENDIX D OF THE KING COUNTY SURFACE WATER DESIGN MANUAL 1998


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1	FINAL PERMIT REVISIONS	L.T.	3/18/05	FIELD BOOK: 1618S/25 06/2000
				SURVEYED: KCDOT 06-2000
				KCDNRP 06-2002
				ESM 06-2004
				SURVEY BASE MAP: LT 09-1999
				CHECKED: TS 09-1999
No.	REVISION	BY	APP'D	DATE



DESIGNED:  
R. BERRYESSA, P.E.  
W. MANSFIELD, P.E.  
DRAWN:  
L. TRAXINGER  
RECOMMENDED:  
R. BERRYESSA, P.E.  
APPROVED:  
D. ALTHAUSER, PE

CHECKED:  
R. BERRYESSA, P.E.  
SCALE:  
AS NOTED  
CONTRACT NO:  
C53011C



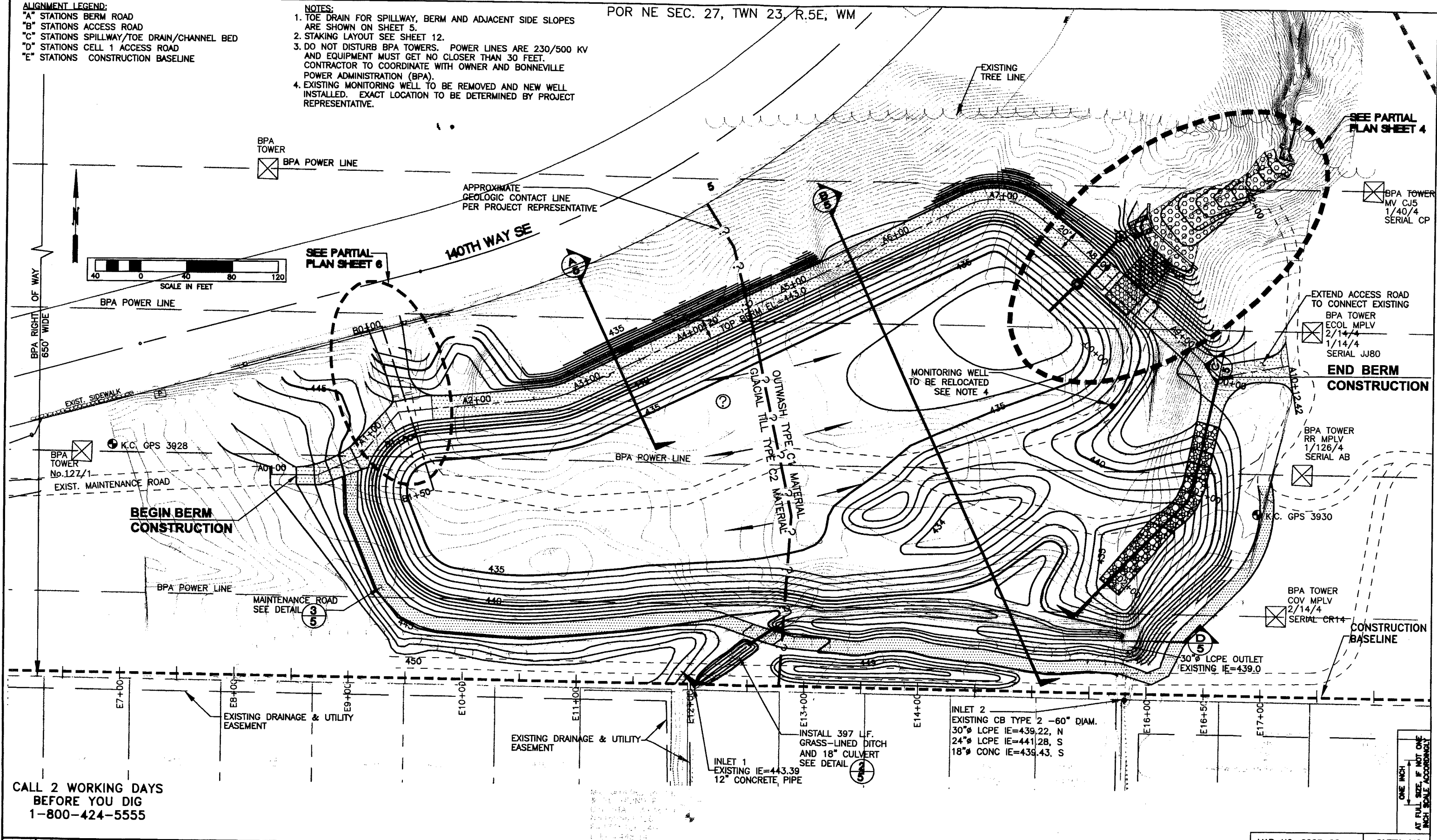
DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
EROSION CONTROL PLAN AND NOTES

MAP-NO. 2003-92	CNTRL-NO
DATE: APRIL 2005	FILE NO:
DRAWING NO: C1	SHEET NO: 2 OF 13

**ALIGNMENT LEGEND:**  
 "A" STATIONS BERM ROAD  
 "B" STATIONS ACCESS ROAD  
 "C" STATIONS SPILLWAY/TOE DRAIN/CHANNEL BED  
 "D" STATIONS CELL 1 ACCESS ROAD  
 "E" STATIONS CONSTRUCTION BASELINE

- NOTES:**  
 1. TOE DRAIN FOR SPILLWAY, BERM AND ADJACENT SIDE SLOPES ARE SHOWN ON SHEET 5.  
 2. STAKING LAYOUT SEE SHEET 12.  
 3. DO NOT DISTURB BPA TOWERS. POWER LINES ARE 230/500 KV AND EQUIPMENT MUST GET NO CLOSER THAN 30 FEET. CONTRACTOR TO COORDINATE WITH OWNER AND BONNEVILLE POWER ADMINISTRATION (BPA).  
 4. EXISTING MONITORING WELL TO BE REMOVED AND NEW WELL INSTALLED. EXACT LOCATION TO BE DETERMINED BY PROJECT REPRESENTATIVE.

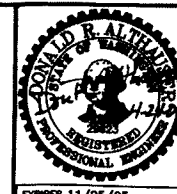
POR NE SEC. 27, T2N 23, R.5E, WM



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1	FINAL PERMIT REVISIONS	LT.	3/18/05
No.	REVISION	BY	APP'D DATE

FIELD BOOK: 1618S/25 06/2000  
 SURVEYED: KCDOT 06-2000  
 KCDNRP 06-2002  
 ESM 06-2004  
 SURVEY BASE MAP: LT 09-1999  
 CHECKED: TS 09-1999

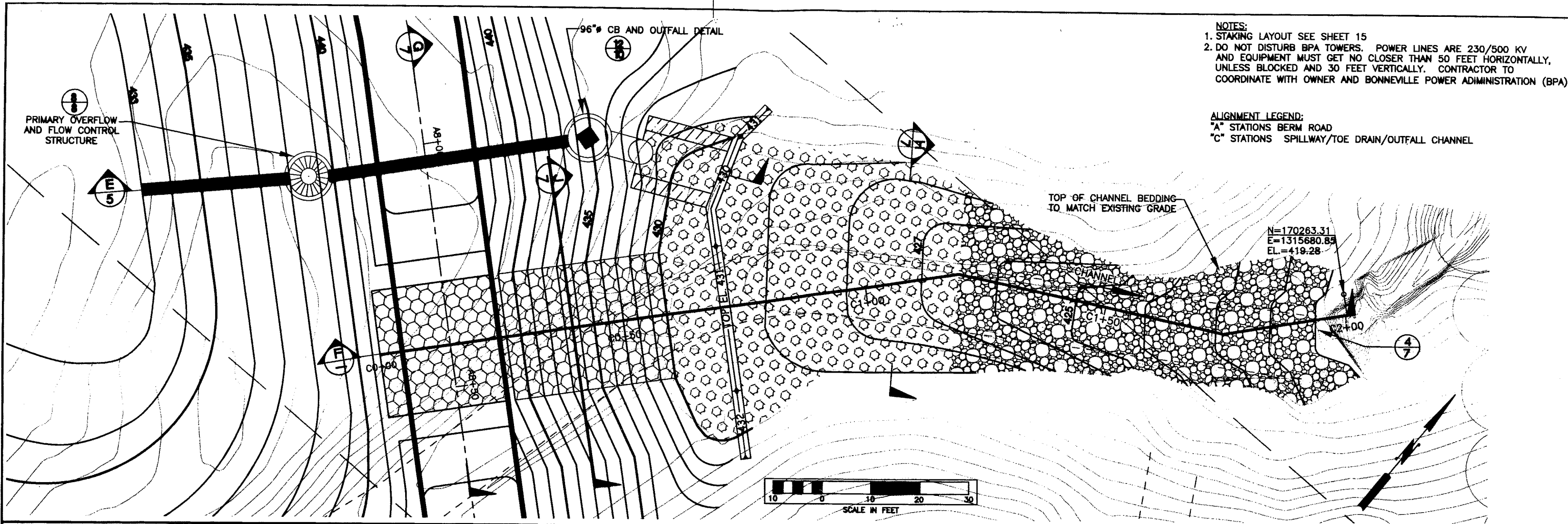


DESIGNED: R. BERRYESSA, P.E.  
 W. MANSFIELD  
 DRAWN: L. TRAXINGER  
 RECOMMENDED: R. BERRYESSA, P.E.  
 APPROVED: D. ALTHAUSER, PE  
 CHECKED: R. BERRYESSA, P.E.  
 SCALE: AS NOTED  
 CONTRACT NO: C53011C



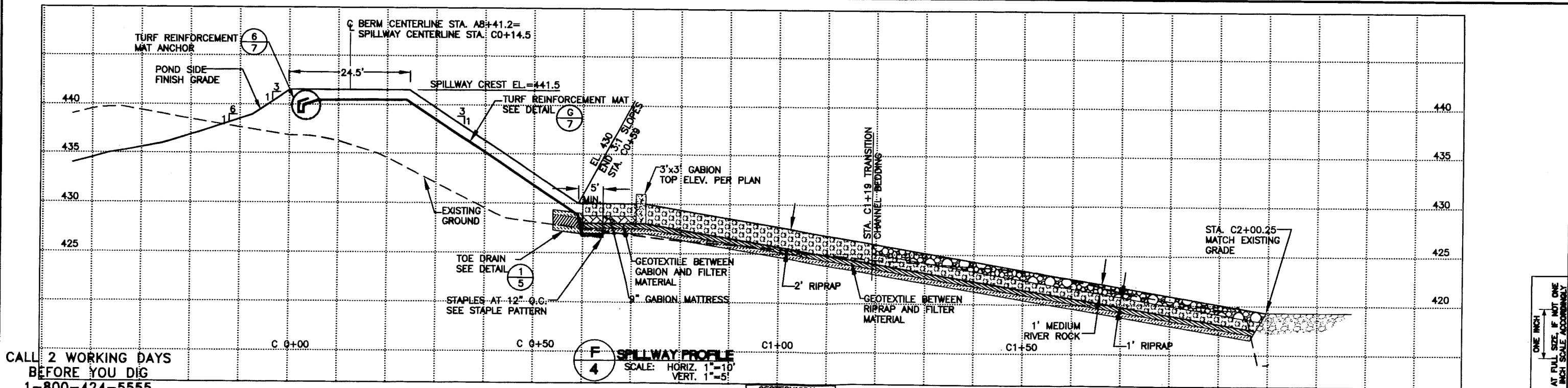
DEPARTMENT OF NATURAL RESOURCES AND PARKS  
 WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
**POND GRADING PLAN**

MAP-NO. 2003-92  
 CNTRL-NO  
 DATE: APRIL 2005  
 FILE NO:  
 DRAWING NO: C2  
 SHEET NO: OF 3



NOTES:  
 1. STAKING LAYOUT SEE SHEET 15  
 2. DO NOT DISTURB BPA TOWERS. POWER LINES ARE 230/500 KV AND EQUIPMENT MUST GET NO CLOSER THAN 50 FEET HORIZONTALLY, UNLESS BLOCKED AND 30 FEET VERTICALLY. CONTRACTOR TO COORDINATE WITH OWNER AND BONNEVILLE POWER ADMINISTRATION (BPA).

ALIGNMENT LEGEND:  
 "A" STATIONS BERM ROAD  
 "C" STATIONS SPILLWAY/TOE DRAIN/OUTFALL CHANNEL

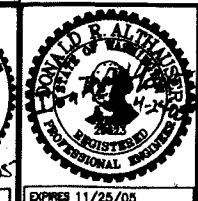
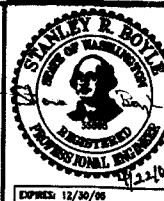


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No.	REVISION	BY	APP'D	DATE
1	FINAL PERMIT REVISIONS	L.T.		3/18/05

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 W. MANSFIELD, P.E.  
 DRAWN:  
 L. TRAXINGER  
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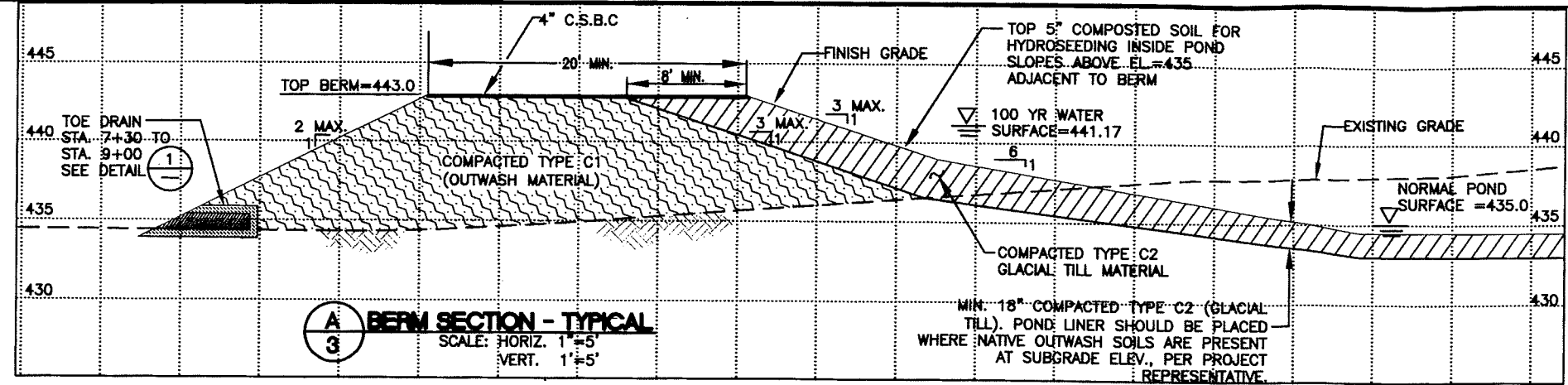
DEPARTMENT OF NATURAL RESOURCES AND PARKS  
 WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
 PARTIAL PLAN AND POND OUTLET PROFILE

MAP-NO. 2003-92

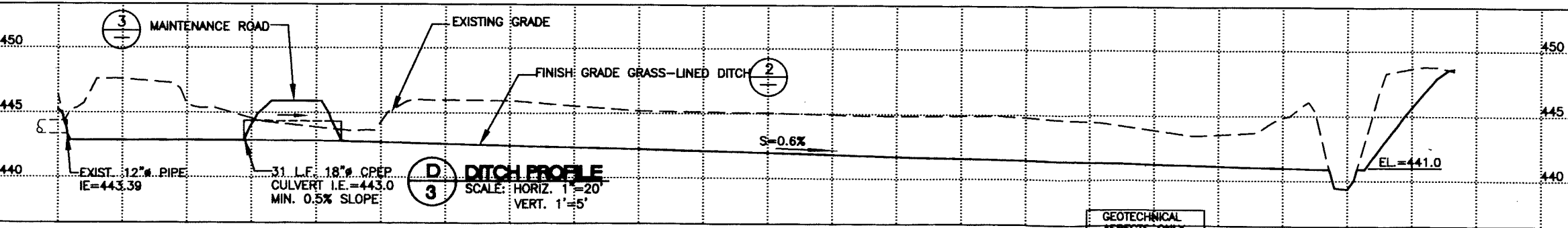
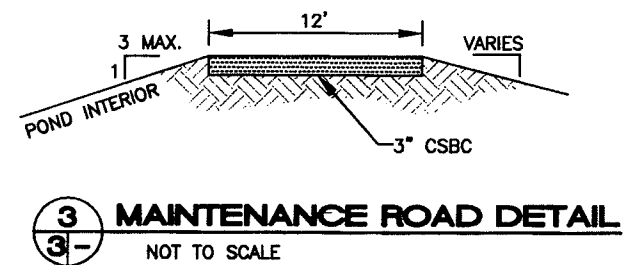
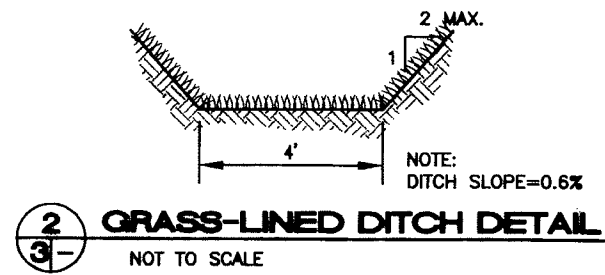
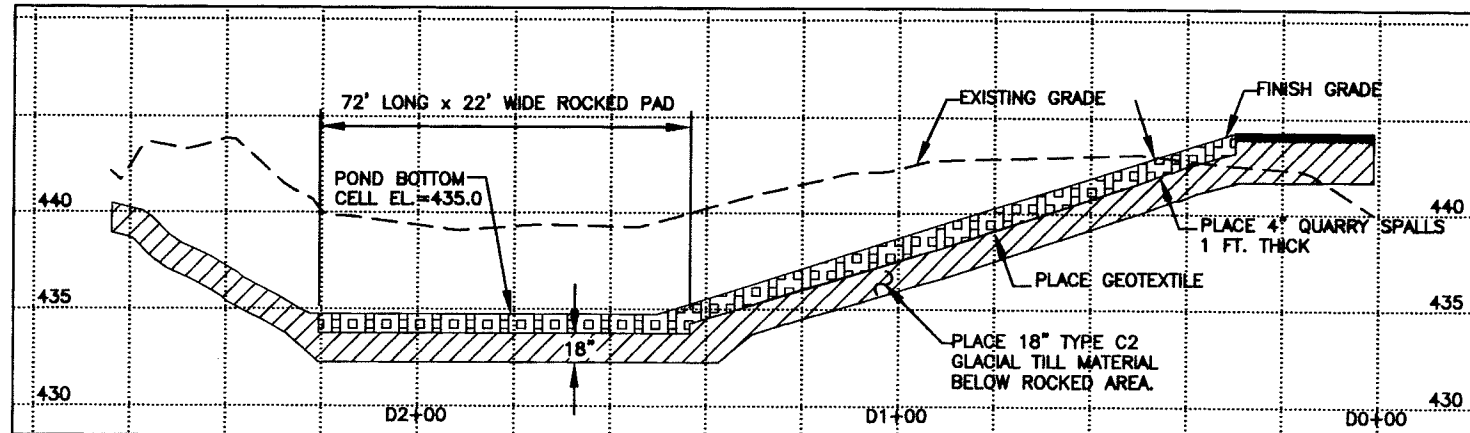
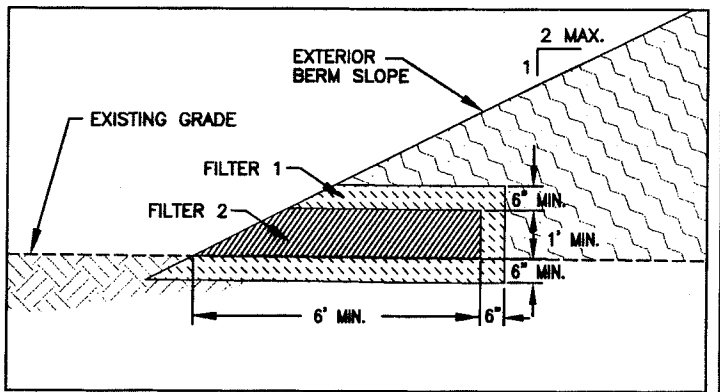
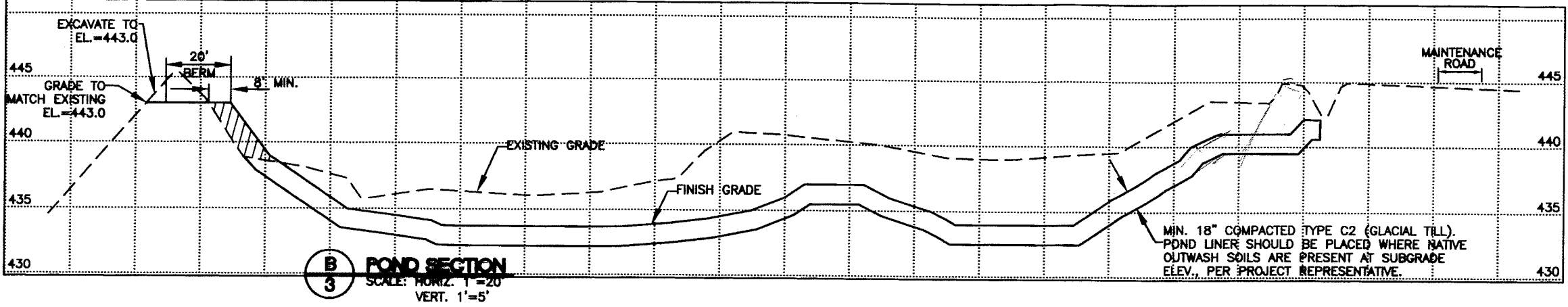
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DATE:  
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 FILE NO:  
 DRAWING NO:  
 C3  
 SHEET NO: 4 OF 4

ONE INCH  
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 INCH SCALE ACCORDINGLY



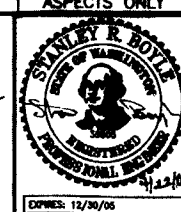
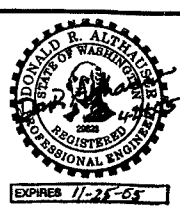
- NOTES:**
1. EMBANKMENT FOUNDATION AND POND AREA SHALL BE VISUALLY OBSERVED AND APPROVED BY PROJECT REPRESENTATIVE PRIOR TO EMBANKMENT AND LINER CONSTRUCTION. PER SPECIFICATION SECTION 2200-3.01-B.
  2. BERM LIFT COMPACTION SHALL BE OBSERVED BY PROJECT REPRESENTATIVE.
  3. PROVIDE TOE DRAIN BETWEEN STA. A7+30 AND A9+00.
  4. WHEN SPRINGS OR WET AREAS ARE FOUND AND BETWEEN STA. A2+50 AND A7+30, A LAYER OF FILTER 1 MATERIAL WILL BE REQUIRED BELOW THE EMBANKMENT FILL AS DIRECTED BY THE PROJECT REPRESENTATIVE.
  5. BENCHING REQUIRED TO KEY EMBANKMENT INTO SLOPE AS SPECIFIED BY THE PROJECT REPRESENTATIVE.



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1	FINAL PERMIT REVISIONS	LT.	3/18/05
No.	REVISION	BY	APP'D DATE

FIELD BOOK:	1618S/25	06/2000
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	KCDNRP	06-2002
	ESM	06-2004
SURVEY BASE MAP:	LT	09-1999
CHECKED:	TS	09-1999



DESIGNED:  
R. BERRYESSA, P.E.  
W. MANSFIELD

DRAWN:  
L. TRAXINGER

RECOMMENDED:  
R. BERRYESSA, P.E.

APPROVED:  
D. ALTHAUSER, PE

CHECKED:  
R. BERRYESSA, P.E.

SCALE:  
AS NOTED

CONTRACT NO:  
C53011C



DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION

**MADSEN CREEK**

**WEST BASIN WATER QUALITY IMPROVEMENT**

**POND CROSS SECTIONS AND BERM DETAIL**

MAP-NO. 2003-92

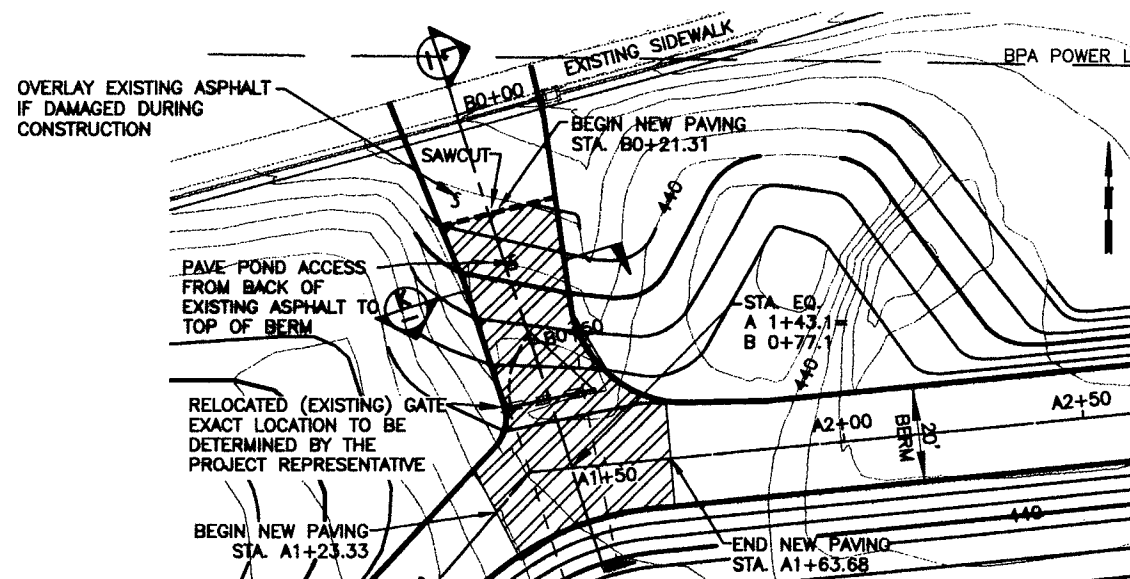
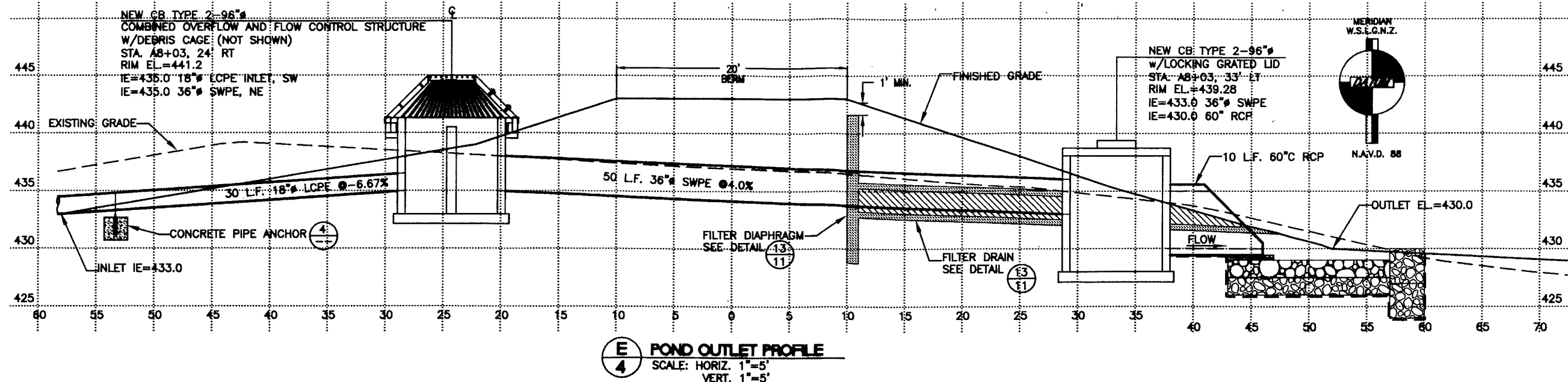
CNTRL-NO

DATE:  
APRIL 2005

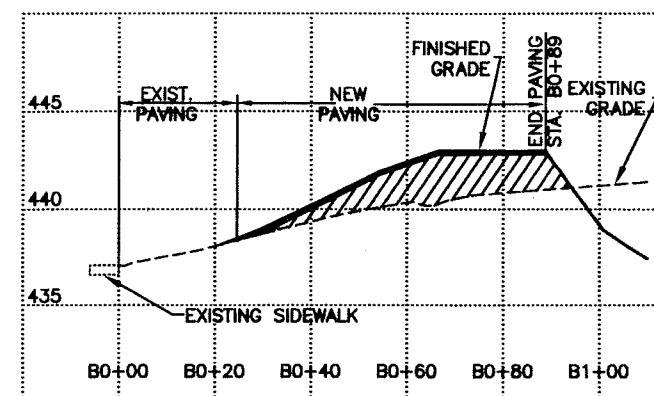
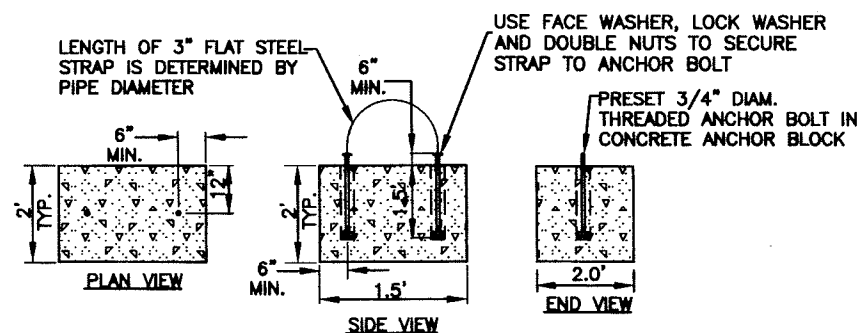
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DRAWING NO:  
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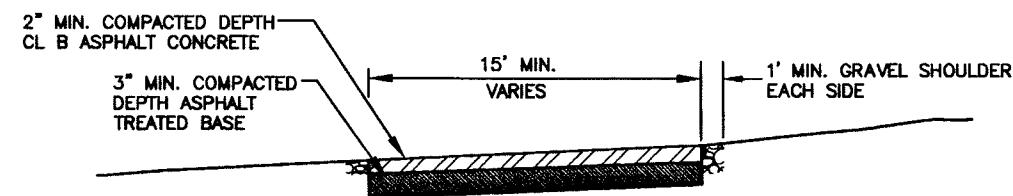
SHEET NO: 5 OF 10



**POND ACCESS ROAD ENTRANCE @ 140TH WAY SE - PARTIAL PLAN**  
STA. B 0+00 TO B 1+24  
SCALE: 1"=20'



**L ACCESS ROAD - SECTION**  
HORIZONTAL SCALE: 1"=20'  
VERTICAL SCALE: 1"=5'



**K PAVING SECTION - TYP.**  
NOT TO SCALE

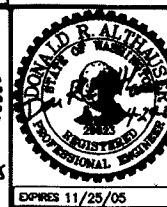
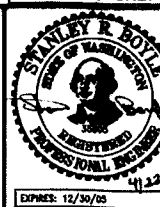
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INCH SCALE ACCORDINGLY

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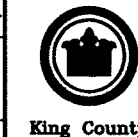
**SHANNON & WILSON, INC.**  
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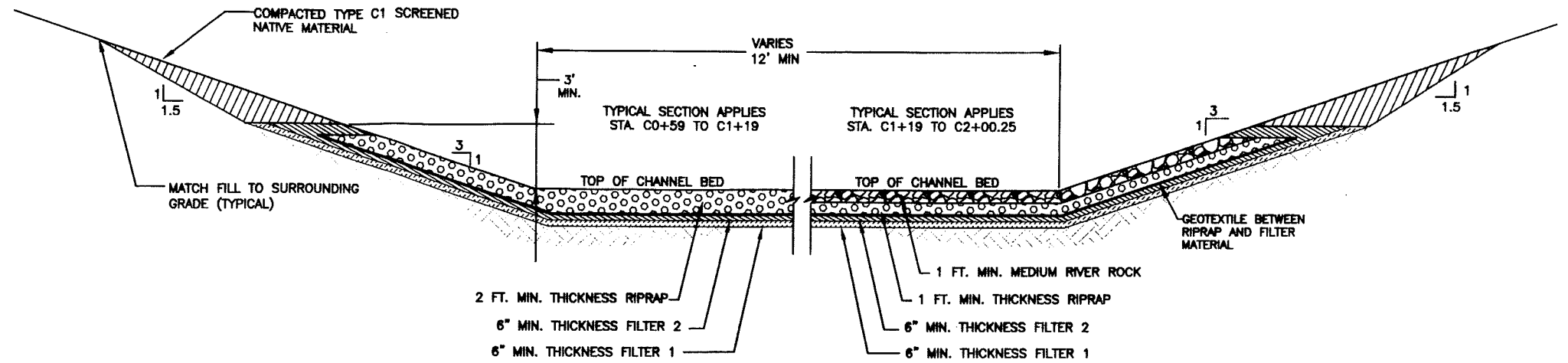
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W. MANSFIELD  
DRAWN:  
L. TRAXINGER  
RECOMMENDED:  
R. BERRYESSA, P.E.  
APPROVED:  
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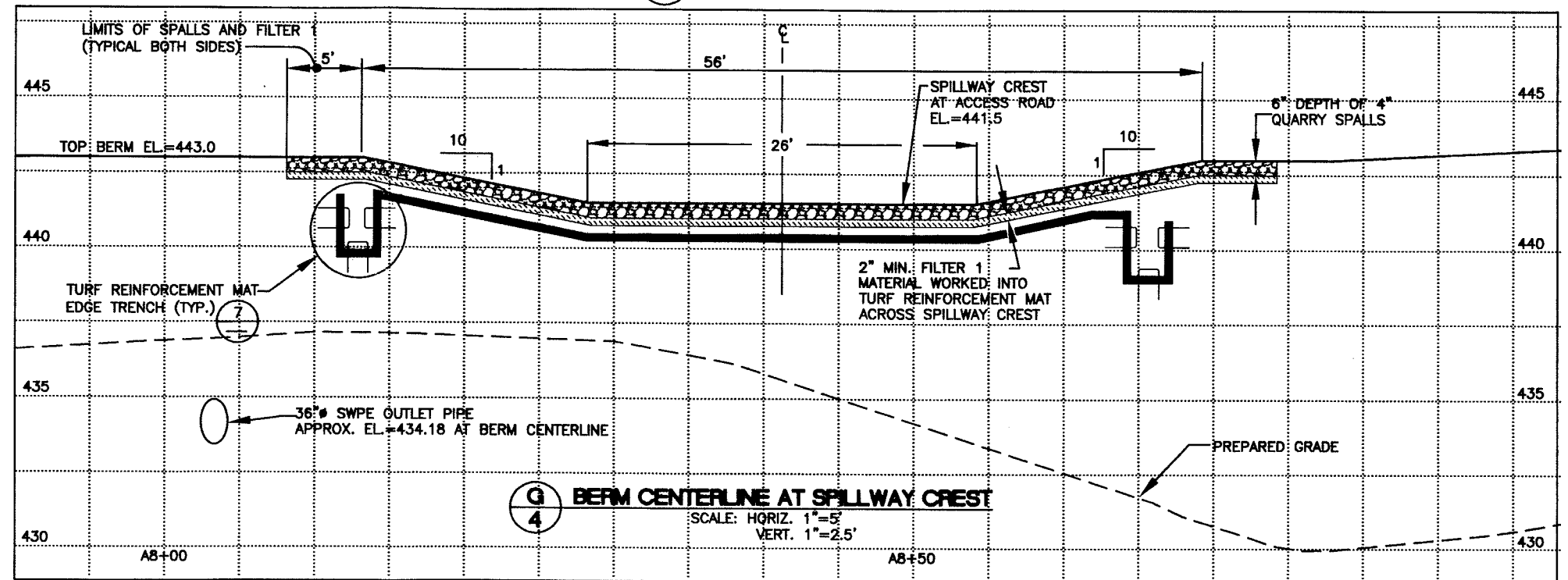


DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
DRAINAGE OUTLET AND BERM SECTIONS  
AND MISCELLANEOUS DETAILS

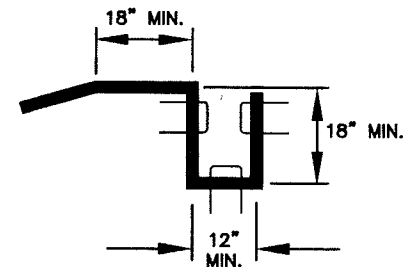
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CNTRL-NO  
DATE:  
APRIL 2005  
FILE NO:  
DRAWING NO:  
C5  
SHEET NO: 6 OF 9



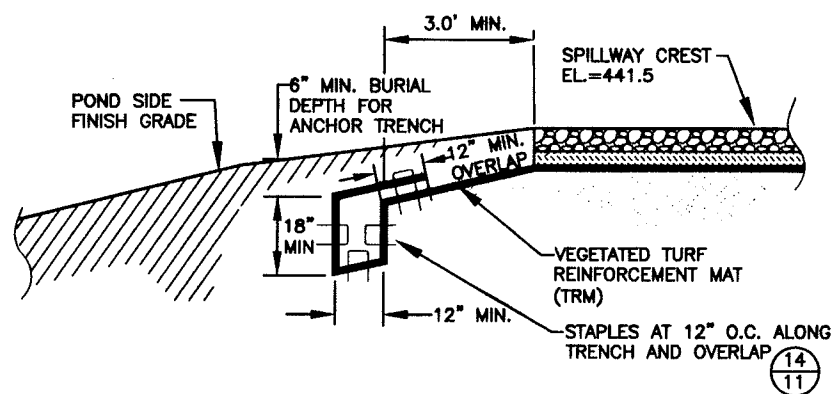
**H** TYPICAL CHANNEL SECTION  
NOT TO SCALE



**G** BERM CENTERLINE AT SPILLWAY CREST  
SCALE: HORIZ. 1"=5'  
VERT. 1"=2.5'



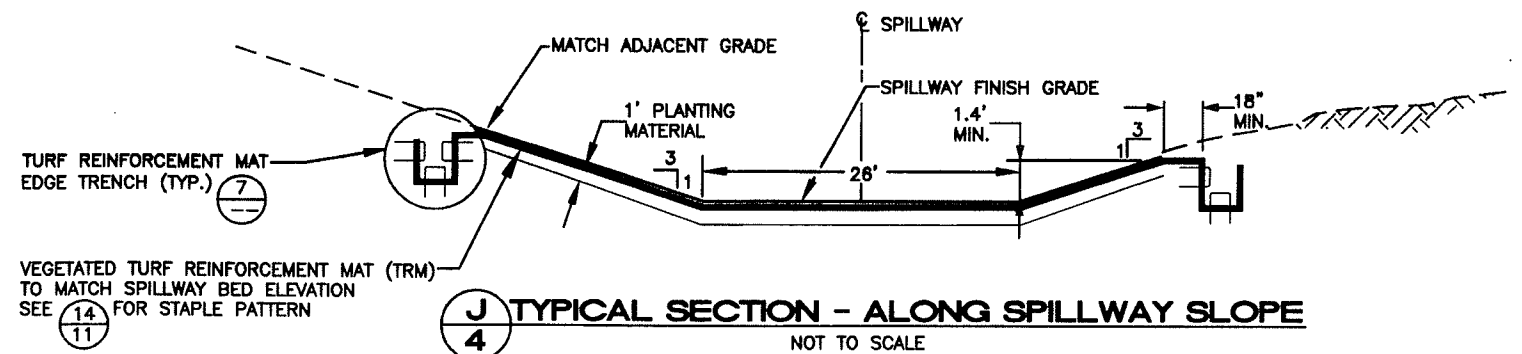
**7** TURF REINFORCEMENT MAT - EDGE TRENCH (TYP.)  
NOT TO SCALE



**6** TURF REINFORCEMENT MAT - ANCHOR DETAIL  
NOT TO SCALE

NOTE:  
REFER TO SHEET 11 TURF REINFORCEMENT MAT AND STAPLE  
PATTERN GUIDE DETAILS FOR INSTALLATION DETAILS.

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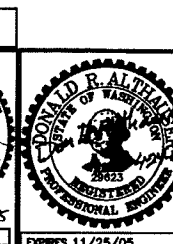
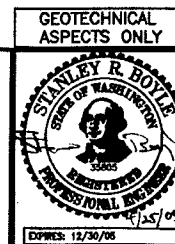


**J** TYPICAL SECTION - ALONG SPILLWAY SLOPE  
NOT TO SCALE

ONE INCH  
AT FULL SIZE IF NOT ONE  
INCH SCALE ACCORDINGLY

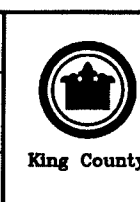
1	FINAL PERMIT REVISIONS	LT.	3/18/05
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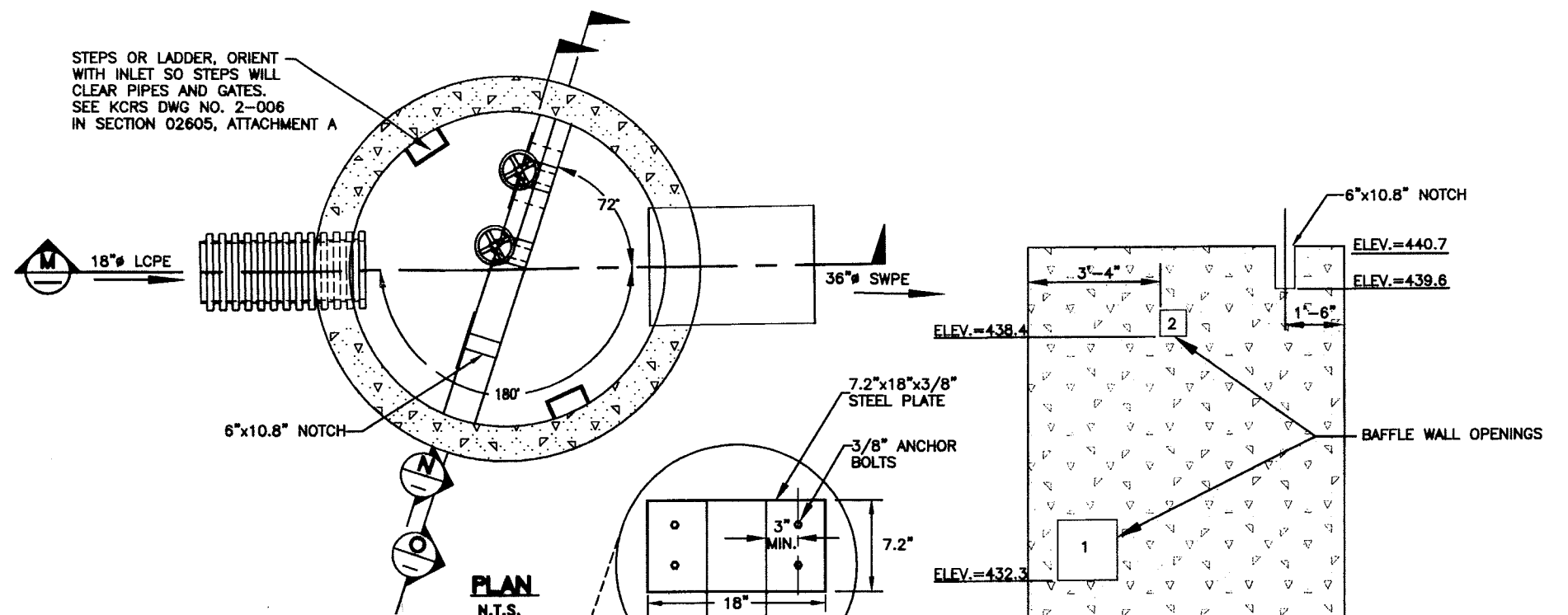
DESIGNED:  
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W. MANSFIELD  
DRAWN:  
L. TRAXINGER  
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R. BERRYESSA, P.E.  
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DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
**SPILLWAY TURF REINFORCEMENT MAT**  
**AND SPILLWAY CHANNEL DETAILS**

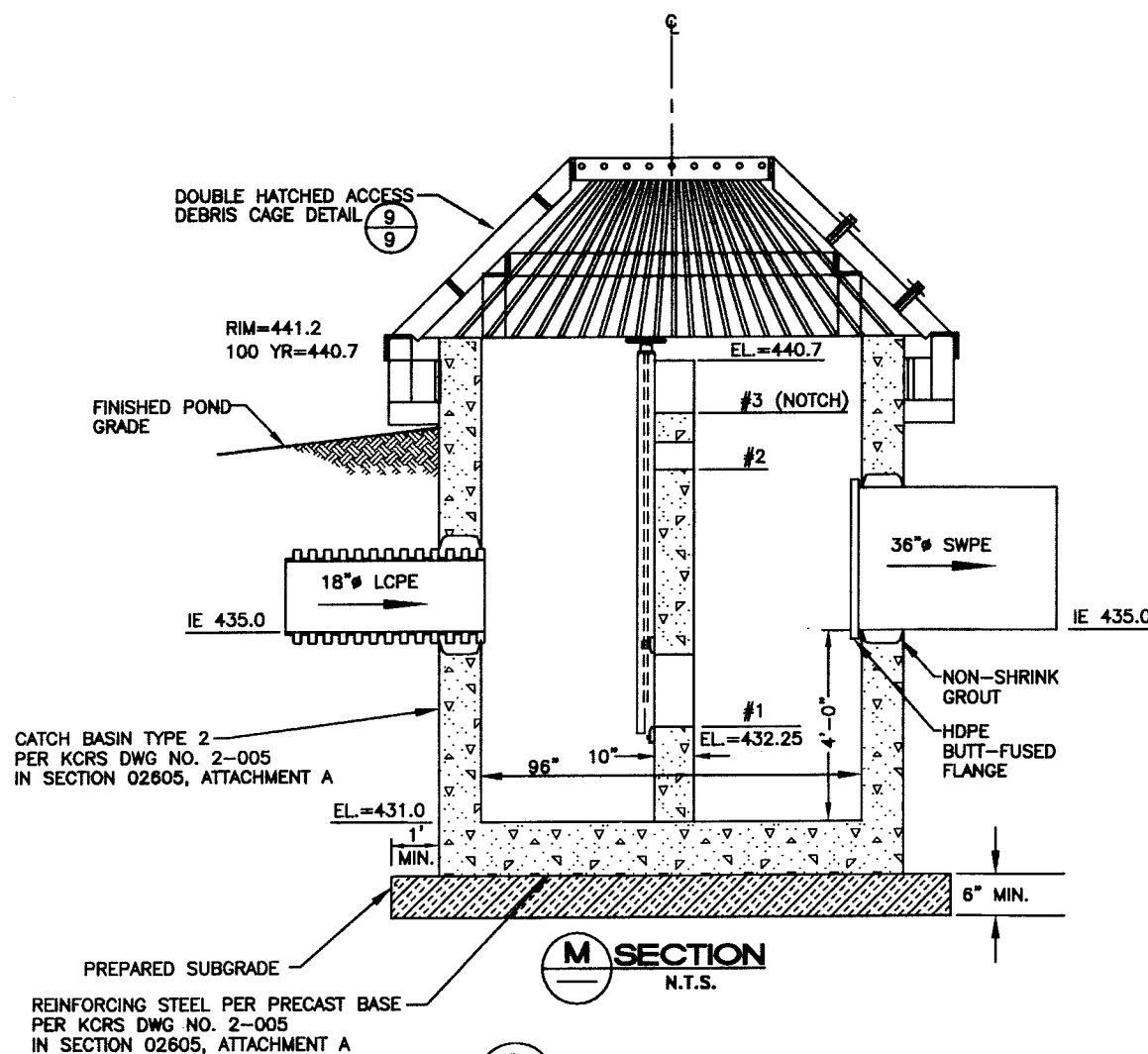
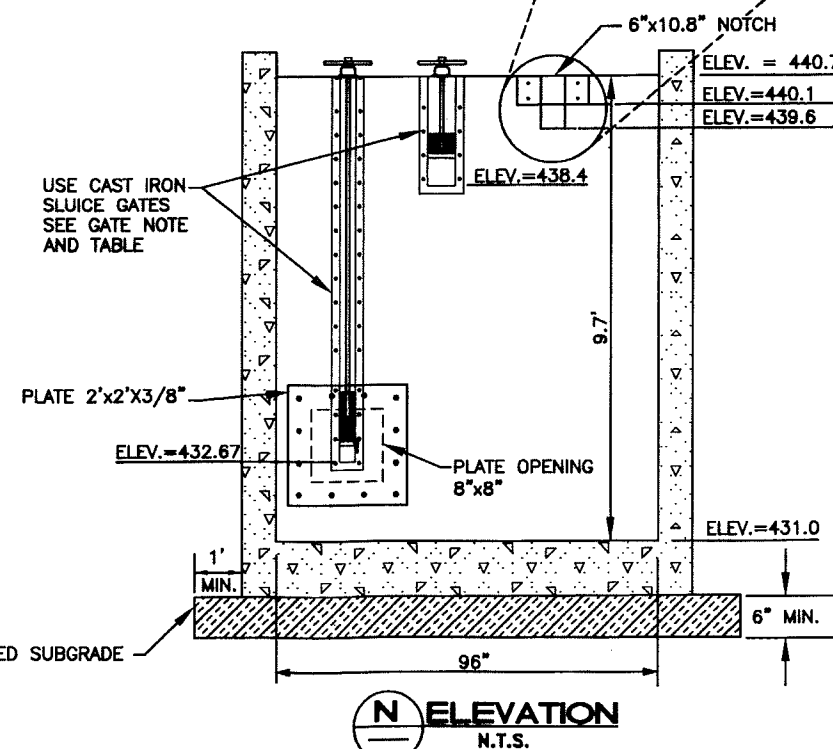
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CNTRL-NO  
DATE:  
APRIL 2005  
FILE NO:  
DRAWING NO:  
C6  
SHEET NO: 7 OF 13



**BAFFLE SECTION**  
SCALE 1" = 2'

OPENING NO.	WIDTH	HEIGHT	BOTTOM GATE ELEV.
1	18"	18"	432.3
2	8"	8"	438.4
3 (NOTCH)	6"	4.8"	439.6

- NOTES: 1. INSTALL SELF-CONTAINED CAST IRON SLUICE GATES W/NON-RISING STEMS. MOUNT VERTICALLY W/CAST IRON WALL THIMBLES AND WEDGES. USE BRONZE ASTM B584 THRUST NUT AND ASTM A276, TYPE 304 STAINLESS STEEL ASSEMBLY AND ANCHOR BOLTS
2. BAFFLE SECTION MEASUREMENTS ARE TAKEN FROM THE INSIDE OF THE MANHOLE.
3. BAFFLE AND CATCH BASIN REINFORCEMENT TO BE DETERMINED BY SUPPLIER.
4. NORMAL OPERATION OF GATE OPENINGS:  
GATE 1: OPENING 0.12'  
BOTTOM EL.=432.67  
TOP EL.=433.12  
GATE 2: OPENING 0.50'  
BOTTOM EL.=438.4  
TOP EL.=438.86  
PLATE ATTACHED TO NOTCH:  
OPENING 0.46'  
BOTTOM EL.=439.6  
TOP EL.=440.70  
PLATE IS MEASURED AT 18"W x 7.2"H



**8 96"± COMBINED OVERFLOW AND FLOW CONTROL STRUCTURE**  
412 SCALE 1" = 2'

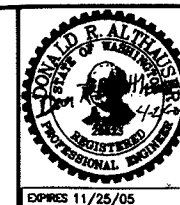
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ONE INCH  
AT FULL SIZE IF NOT ONE  
INCH SCALE ACCORDING

MAP-NO. 2003-92	CNTRL-NO
DEPARTMENT OF NATURAL RESOURCES AND PARKS WATER AND LAND RESOURCES DIVISION	DATE: APRIL 2005
<b>MADSEN CREEK</b> <b>WEST BASIN WATER QUALITY IMPROVEMENT</b> <b>COMBINED OVERFLOW AND FLOW CONTROL STRUCTURE</b>	FILE NO:
	DRAWING NO: C7
	SHEET NO: OF 8 13

No.	REVISION	BY	APP'D	DATE
1	FINAL PERMIT REVISIONS			3/18/05

FIELD BOOK:	1618S/25	06/2000
SURVEYED:	KCDOT	06-2000
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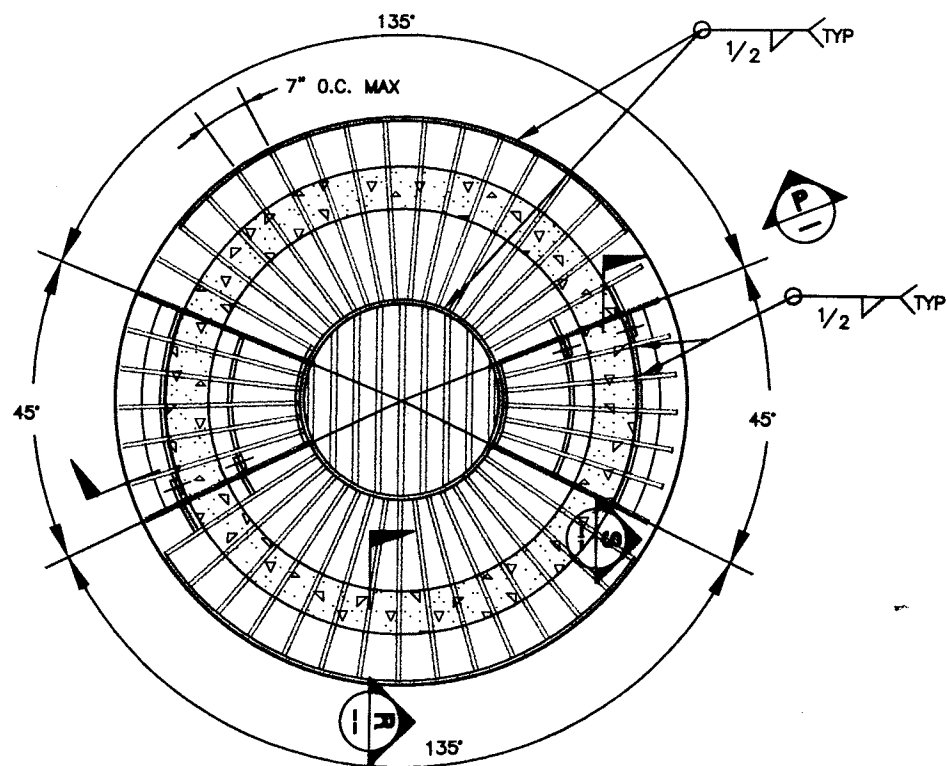


DESIGNED: R. BERRYESSA, P.E. W. MANSFIELD	CHECKED: R. BERRYESSA, P.E.
DRAWN: L. TRAXINGER	SCALE: AS NOTED
RECOMMENDED: R. BERRYESSA, P.E.	CONTRACT NO: C53011C
APPROVED: D. ALTHAUSER, PE	

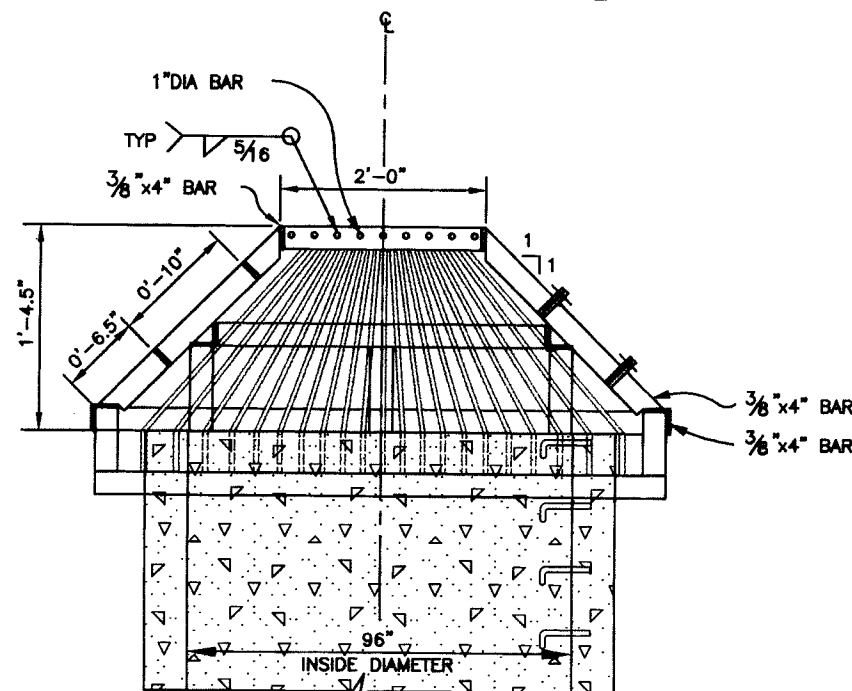


DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION

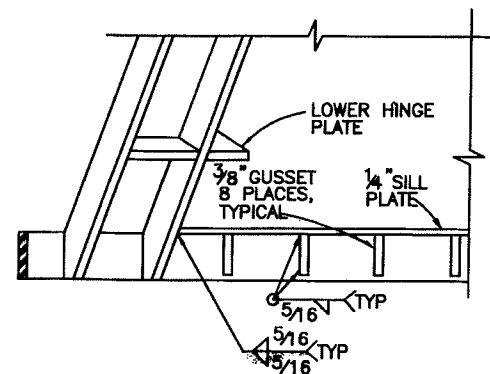
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
**COMBINED OVERFLOW AND FLOW CONTROL STRUCTURE**



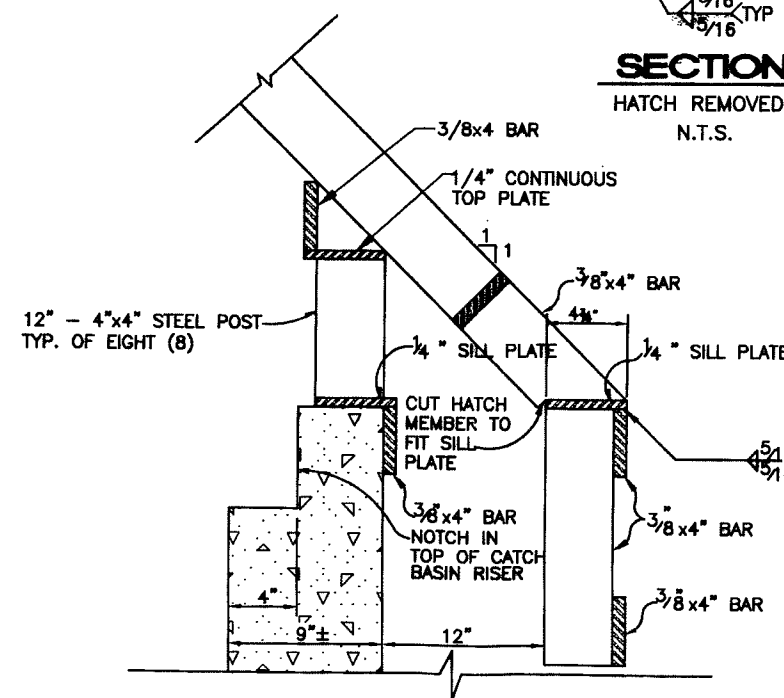
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N.T.S.



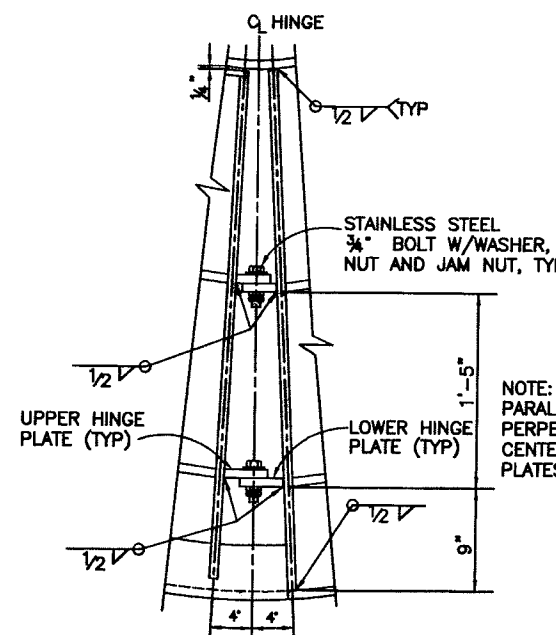
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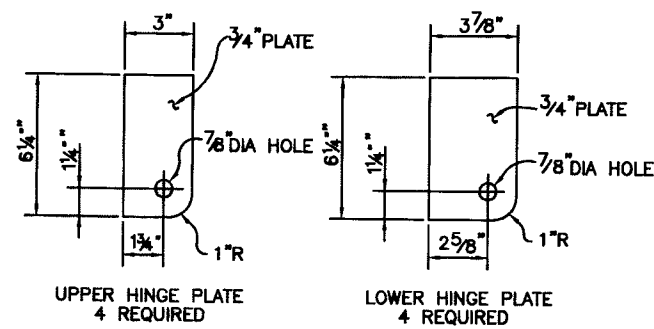
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N.T.S.



**SECTION R**  
N.T.S.



**DETAIL 10**  
N.T.S.

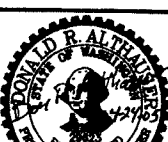



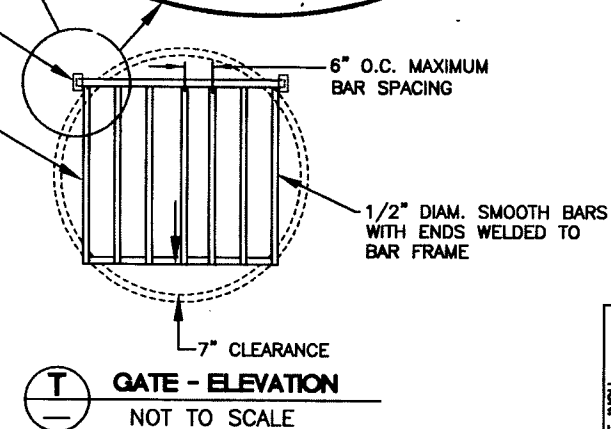
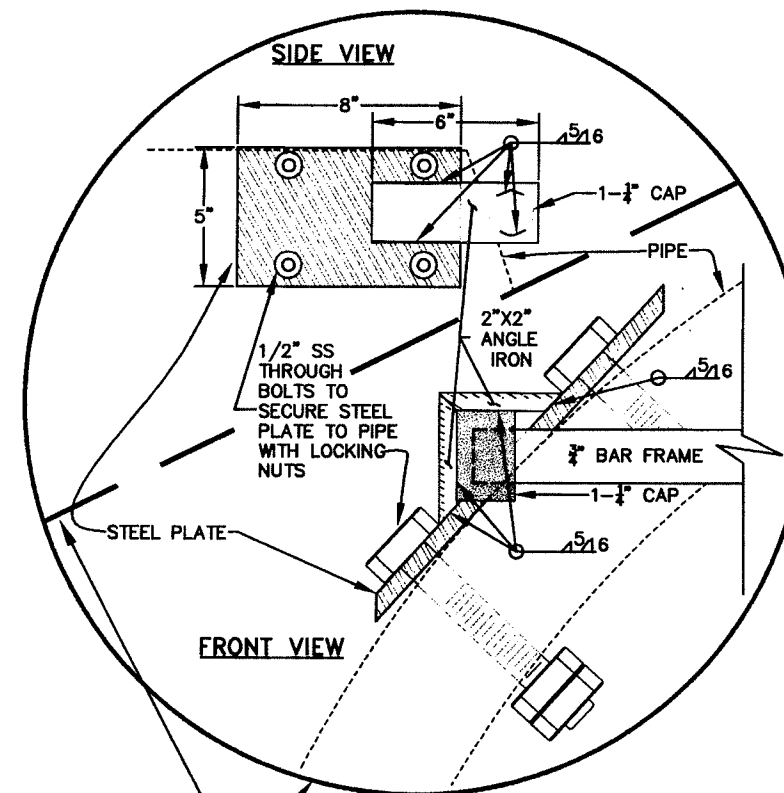
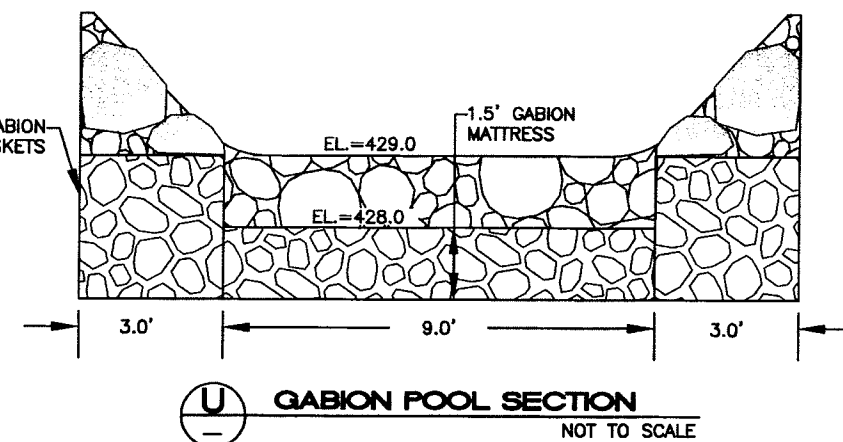
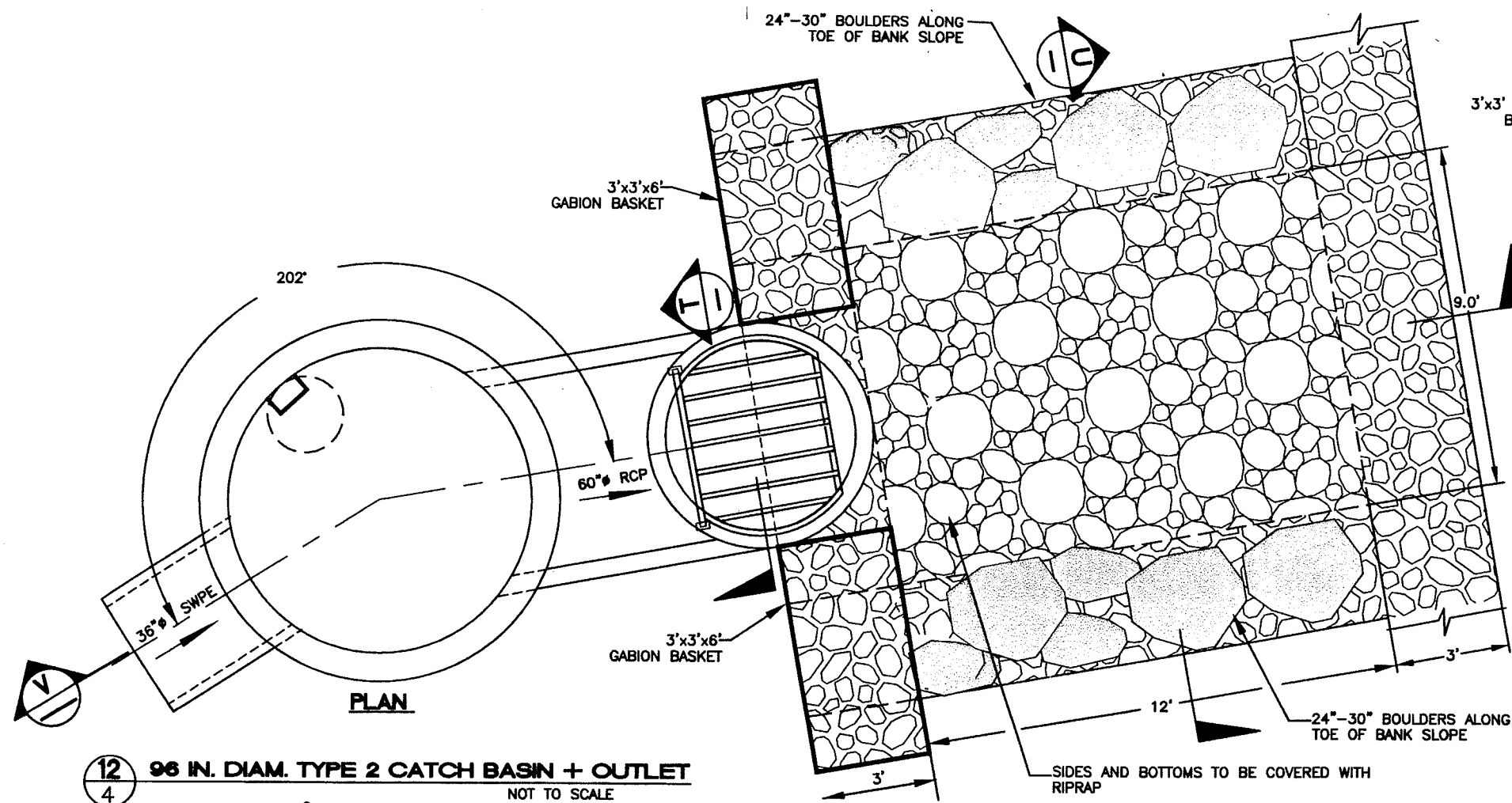
**DETAIL 11**  
N.T.S.

NOTE: LOCATE HINGE PLATES PARALLEL TO EACH OTHER AND PERPENDICULAR TO HINGE CENTERLINE. SEE DETAIL FOR HINGE PLATES (11)

CALL 2 WORKING DAYS BEFORE YOU DIG  
1-800-424-5555

ONE INCH  
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

1	FINAL PERMIT REVISIONS	LT.		3/18/05	FIELD BOOK: 1618S/25 06/2000		DESIGNED: R.P.B. R. BERRYESSA, P.E. W. MANSFIELD <i>WPM</i>	CHECKED: R.P.B. R. BERRYESSA, P.E.		King County	DEPARTMENT OF NATURAL RESOURCES AND PARKS WATER AND LAND RESOURCES DIVISION  <b>MADSEN CREEK</b> <b>WEST BASIN WATER QUALITY IMPROVEMENT</b> <b>DEBRIS CAGE DETAILS</b>	DATE: APRIL 2005
					SURVEYED: KCDOT 06-2000			SCALE:				FILE NO:
					KCDNRP 06-2002			AS NOTED				
					ESM 06-2004							DRAWING NO: C 8
					SURVEY BASE MAP: LT 09-1999			CONTRACT NO: C53011C				SHEET NO: 9 OF 13
					CHECKED: TS 09-1999							
No.	REVISION	BY	APP'D	DATE								



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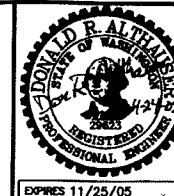
MAP-NO. 2003-92 CNTRL-NO

DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
DRAINAGE STRUCTURE AND OUTFALL DETAILS

DATE:  
APRIL 2005  
FILE NO:  
DRAWING NO:  
C 9  
SHEET NO: OF 13

No.	REVISION	BY	APP'D	DATE
1	FINAL PERMIT REVISIONS			3/18/05

FIELD BOOK: 1618S/25 06/2000  
SURVEYED: KCDOT 06-2000  
KCDNRP 06-2002  
ESM 06-2004  
SURVEY BASE MAP: LT 09-1999  
CHECKED: TS 09-1999



DESIGNED: R. BERRYESSA, P.E.  
W. MANSFIELD  
CHECKED: R. BERRYESSA, P.E.  
SCALE: AS NOTED  
CONTRACT NO: C53011C  
APPROVED: D. ALTHAUSER, PE



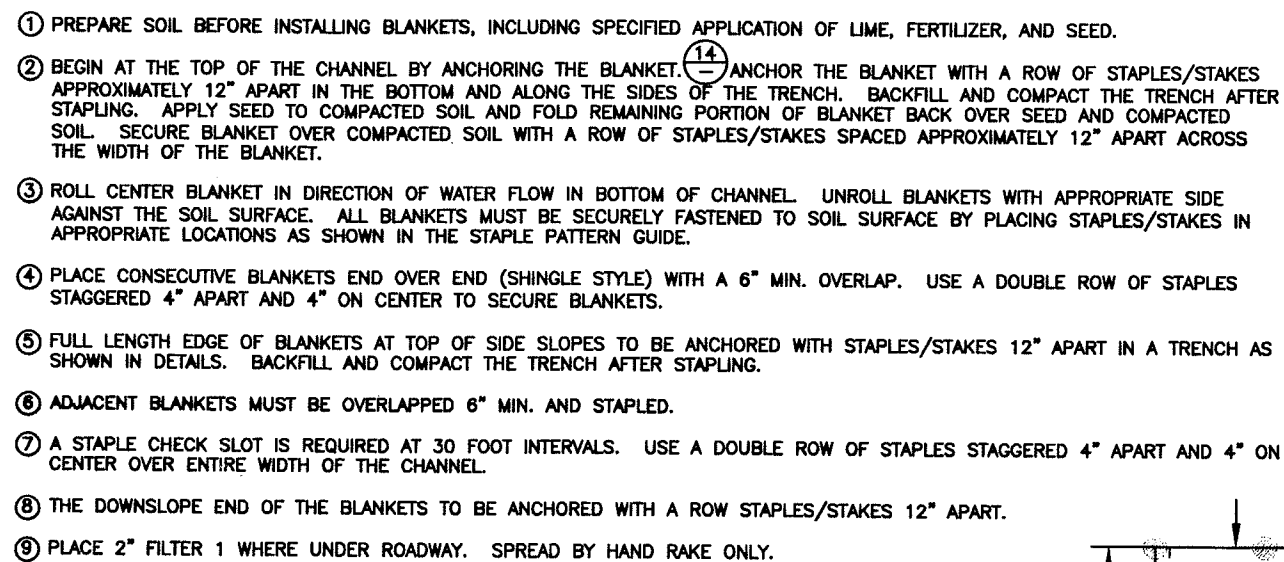
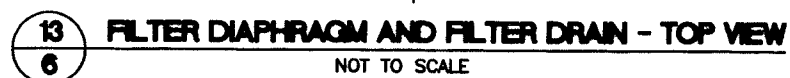


Diagram illustrating the construction details of a wall section, showing dimensions and reinforcement:

- Wall height: 4'
- Wall thickness: 2'
- Seam location (from right edge): 3.3'
- Seam width (from top edge): 6" MIN. (TYPICAL)
- Reinforcement bar: SEAM STITCH

1.7 STAPLES PER SQ. YD.

**14 STAPLE PATTERN GUIDE**  
N.T.S.

**CALL 2 WORKING DAYS  
BEFORE YOU DIG  
1-800-424-5555**

MAP-NO. 2003-92

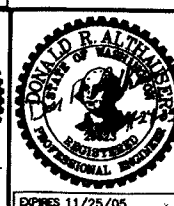
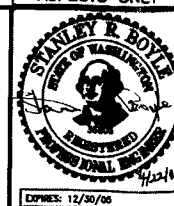
CNTRL-NO

DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION

**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
**FILTER DIAPHRAGM AND FILTER DRAIN DETAILS AND**  
**SPILLWAY TURF REINFORCEMENT MAT INSTALLATION GUIDE**

DATE:	APRIL 2005
FILE NO:	
DRAWING NO:	C 10
SHEET NO:	1 OF 1

1	FINAL PERMIT REVISIONS	L.T.	3/18/05
No.	REVISION	BY	APP'D DATE



DESIGNED: *RJB*  
R. BERRYESSA, P.E.  
W. MANSFIELD *Wm*

DRAWN:  
L. TRAXINGER

RECOMMENDED: *RJB*  
R. BERRYESSA, P.E.

APPROVED: *DJA*  
D. ALTHAUSER, PE

CHECKED: <i>RJB</i> R. BERRYESSA, P.E.
SCALE:  AS NOTED
CONTRACT NO:  C53011C



King County

BERM CENTERLINE STAKING TABLE					
Station	Point No.	Northing	Easting	Elev.	Description
A0+00	500	169968.35	1314798.65	449.00	BEGIN BERM
A0+41.49	501	169970.21	1314840.07	446.83	
A0+80.54	502	169986.56	1314876.75	443.70	
A1+30.64	503	170026.54	1314910.82	443.00	
A2+58.39	504	170039.47	1315037.91	443.00	
A2+86.75	505	170047.16	1315065.05	443.00	
A6+66.88	506	170213.00	1315407.10	443.00	
A7+30.35	507	170206.67	1315467.01	443.00	
A7+73.62	508	170180.07	1315501.13	443.00	
A9+50.61	509	170064.39	1315630.39	444.00	
A10+12.42	510	170074.60	1315691.35	EXIST. GRADE	END BERM END ACCESS ROAD

THIS SURVEY DOES NOT REPRESENT A BOUNDARY SURVEY OF PROPERTY OR RIGHTS OF WAY

ALL COORDINATES SHALL BE IN ACCORDANCE WITH THE KING COUNTY CODE AND THE PERMITS ASSOCIATED WITH THE PROJECT.

BASIS OF BEARINGS FOR THIS PROJECT IS THE LINE BETWEEN SURVEY POINTS #250 AND #3927 BASED ON GPS VALUE AS DESCRIBED IN FIELD BOOK 1618, VOLUME S, PAGE 25.

BASIS OF COORDINATES FOR THIS PROJECT IS FOUND MONUMENT IN CASE, SURVEY POINT #250 AT THE INTERSECTION OF 143RD PL SE AND SE 162ND ST. WITH THE COORDINATES N169569.726, E1315166.04

K.C. GPS 3928  
N=169996.12  
E=1314660.58  
EL=454.86

CONSTRUCTION BASELINE  
STA. 6+00  
N=169795.65  
E=1314568.35

DRAINAGE COORDINATE TABLE					
STRUCTURE	NORTHING	EASTING	STATION	OFFSET	
8 8	FLOW CONTROL/OVERFLOW	170144.66	1315504.55	A8+03.3	24.10' RT
12 10	96" CB	170187.57	1315542.75	A8+03.2	33.34' LT
NOTE: COORDINATES IDENTIFY CENTER OF DRAINAGE STRUCTURES					
PIPE	STATION (FROM)	OFFSET	STATION (TO)	OFFSET	
30 L.F. 18" LCPE	A8+03	55' RT	A8+04	28' RT	
50 L.F. 36" SWPE	A8+06	20' RT	A8+04	29' LT	
RCP AND GABION OUTFALL	A8+06	38' LT	A8+13	49' LT	

ACCESS ROAD @ B ALIGNMENT			
POINT NO.	NORTHING	EASTING	ELEVATION
511	170100.68	1314895.48	437.73
512	170027.44	1314919.66	443.0

SPILLWAY @ /TOE DRAIN C ALIGNMENT			
POINT NO.	NORTHING	EASTING	ELEVATION
513	170137.33	1315548.88	441.5
514	170170.64	1315578.49	430.0

CELL 1 ACCESS ROAD D ALIGNMENT			
POINT NO.	NORTHING	EASTING	ELEVATION
509	170064.39	1315630.39	444.0
515	170022.87	1315620.92	443.0
516	169955.68	1315603.58	437.44
517	169932.58	1315581.81	435.0
518	169884.25	1315536.25	435.0
519	169843.80	1315498.13	440.88

CURVE TABLE BERM ALIGNMENT	
C1	lc=20'03"34" T=14.33 FT R=81.0 FT L=28.36 FT
C2	lc=63'48"01" T=35.48 FT R=57.0 FT L=63.47 FT

DITCH ALIGNMENT (GRASS LINED)			
POINT NO.	NORTHING	EASTING	ELEVATION
520	169791.41	1315173.00	443.39
521	169825.15	1315218.94	443.0
522	169841.61	1315244.80	442.85
523	169837.92	1315393.81	441.0
524	169833.17	1315484.20	441.0
525	169829.30	1315552.00	441.0

EMBANKMENT TOE			
POINT NO.	NORTHING	EASTING	ELEVATION
526	169825.03	1315556.00	441.0
527	169811.87	1315570.08	448.0
528	169825.88	1315393.80	445.0
529	169959.55	1315393.86	435.0
530	169959.72	1314969.58	435.0
531	170030.17	1314946.46	443.0
532	170072.17	1314932.67	439.0

POND (INTERNAL GRADING)			
POINT NO.	NORTHING	EASTING	ELEVATION
533	170029.19	1315284.18	434.27
534	170107.06	1315436.00	433.0
535	170012.83	1315556.17	443.0
536	169977.03	1315487.76	437.0
537	169936.91	1315410.93	434.0
538	169877.97	1315455.38	441.0
539	169930.74	1315525.07	436.0

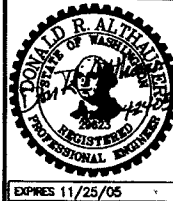
CONSTRUCTION BASELINE E ALIGNMENT			
POINT NO.	NORTHING	EASTING	ELEVATION
540	169795.65	1314568.35	EXIST. GRADE
541	169784.27	1315718.26	EXIST. GRADE

ALIGNMENT LEGEND:  
"A" STATIONS BERM ROAD  
"B" STATIONS ACCESS ROAD  
"C" STATIONS SPILLWAY/TOE DRAIN/CHANNEL  
"D" STATIONS CELL 1 ACCESS ROAD  
"E" STATIONS CONSTRUCTION BASELINE

CALL 2 WORKING DAYS  
BEFORE YOU DIG  
1-800-424-5555

1 FINAL PERMIT REVISIONS		LT.	3/18/05
No.	REVISION	BY	APP'D DATE

FIELD BOOK:	1618S/25	06/2000
SURVEYED:	KCDOT	06-2000
	KCDNRP	06-2002
	ESM	06-2004
SURVEY BASE MAP:	LT	09-1999
CHECKED:	TS	09-1999



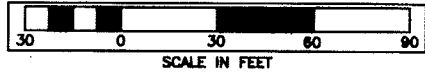
DESIGNED: R. BERRYESSA, P.E. W. MANSFIELD, P.E.	CHECKED: R. BERRYESSA, P.E.
DRAWN: L. TRAXINGER	SCALE: AS NOTED
RECOMMENDED: R.D. BERRYESSA, P.E.	CONTRACT NO: C53011C
APPROVED: D. ALTHAUSER, PE	



DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK  
WEST BASIN WATER QUALITY IMPROVEMENT**  
CONSTRUCTION STAKING PLAN

MAP-NO. 2003-92	CNTL-NO
DATE: APRIL 2005	FILE NO:
DRAWING NO: C 11	SHEET NO. OF 12 13

BPA POWER LINE



140TH WAY S.E.

PLANT LEGEND						
KEY:	QTY.:	SCIENTIFIC NAME:	COMMON NAME:	SIZE:	CONDITION:	SPACING:
X ● * * ○	125	SHRUBS <i>Cornus stolonifera</i>	Red-Osier Dogwood	2 gal.	container	5' o.c.
	115	<i>Ribes sanguineum</i>	Red Flwrng Currant	2 gal.	container	4' o.c.
	240	<i>Rosa gymnocarpa</i>	Bald-hip Rose	2 gal.	container	5' o.c.
	240	<i>Rosa nutkana</i>	Nootka Rose	2 gal.	container	5' o.c.
	110	<i>Symphoricarpos albus</i>	Snowberry	2 gal.	container	4' o.c.
/	2000	EMERGENTS <i>Scirpus acutus</i>	Hardstem Bulrush	plug	container	18" o.c.
	1000	<i>Scirpus microcarpus</i>	Small-Fruited Bulrush	plug	container	12" o.c.

STOCKPILE SITE  
(1.06 ACRES)

CALL 2 WORKING DAYS  
BEFORE YOU DIG  
1-800-424-5555

1	FINAL PERMIT REVISIONS	L.T.	3/18/05
No.	REVISION	BY	APP'D DATE

FIELD BOOK:	1618S/25	06/2000
SURVEYED:	KCDOT	06-2000
	KCDNRP	06-2002
	ESM	06-2004
SURVEY BASE MAP:	LT	09-1999
CHECKED:	TS	09-1999

DESIGNED:	FAUNA NOPP
CHECKED:	FAUNA NOPP
SCALE:	AS NOTED
DRAWN:	FAUNA NOPP
RECOMMENDED:	FAUNA NOPP
APPROVED:	FAUNA NOPP
CONTRACT NO:	C53011C



DEPARTMENT OF NATURAL RESOURCES AND PARKS  
WATER AND LAND RESOURCES DIVISION  
**MADSEN CREEK**  
**WEST BASIN WATER QUALITY IMPROVEMENT**  
**PLANTING PLAN**

MAP-NO. 2003-92	CNTRL-NO
DATE:	APRIL 2005
FILE NO:	
DRAWING NO:	L1
SHEET NO. OF	19 19

## **Appendix B**

### **Sluice Gate Drawings and O&M Manual**

## **SLIDE GATES**

# **OPERATION AND MAINTENANCE MANUAL**

**MANUFACTURER:  
GOLDEN HARVEST, INC.  
PO BOX 287  
BURLINGTON, WA 98233  
360-757-4334  
FAX: 360-757-1135  
[goldenharvestinc.com](http://goldenharvestinc.com)**

GHI NO: 07-0780

2007

## INTRODUCTION

Golden Harvest, Inc., Golden Gates™ has developed a complete line of aluminum and stainless steel gates for distribution worldwide. These products, based on extensive experience in all types of environments, are the results of intensive research, computer, lab, field testing and analysis.

Golden Harvest, Inc.'s, Golden Gate's, Operation and Maintenance Manual, was created, to give information to all personnel, (engineers, contractors, operators, and installers) who will be affected with the operating, maintaining and installing of this equipment.

Every precaution is taken at the factory to insure that superior quality equipment is shipped. However, we cannot be accountable for damage caused by vandalism or negligence after shipping or improper installation of the equipment. Therefore, the information in this manual is Golden Harvest, Inc., Golden Gates TM recommended procedures for handling, storage, installation, adjustment, and initial operation for the related equipment and operating mechanisms to be used in conjunction with the approved installation drawings furnished by Golden Harvest, Inc. If appropriate care and accuracy are observed in the field when installing Golden Harvest, Inc., Golden Gates TM, they will operate as designed at optimum efficiency.

## TABLE OF CONTENTS

AUTHORIZED PARTS AND SERVICE .....	1
OPERATOR SAFETY .....	2
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PARTS LIST .....	2
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SLIDE/WEIR GATE INSTALLATION CHECK LIST AND INITIAL OPERATING INSTRUCTIONS.....	4
SLIDE/WEIR GATE TROUBLE SHOOTING .....	5
EQUIPMENT MAINTENANCE .....	6
LUBRICATION .....	7

## **AUTHORIZED PARTS AND SERVICE**

For service, parts, and/or warranty repair, please contact:

Golden Harvest, Inc  
PO Box 287  
Burlington, WA 98233

Phone: (360) 757-4334  
Fax: (360) 757-1135

**Please reference the Golden Harvest Job # 07-0780 in all correspondence regarding this job**

## OPERATOR SAFETY

Golden Harvest Inc. does not have specific instructions beyond basic plant safety practices for its products.

---

## SPARE PARTS LIST

Golden Harvest Inc. doesn't have any "high wear" parts on this equipment, therefore, no spare parts are recommended.

---

## PARTS LIST

The parts list for each gate is located on the corresponding drawing.

---

## SPECIAL TOOLS

No special tools are required to install or maintain Golden Harvest gates.

## ADJUSTMENT OF GATES WITH P-SEALS

### ADJUSTING:

Check the clearance between the seal and the head following installation with a .002 feeler gauge. Gauge should not pass at any point around the seal perimeter.

### SPECIAL INSTALLATION NOTE:

Any dual operated or wide (60" or over) weir or slide gate  
'P' seals are to be adjusted after installation of gate to wall.

### TO ADJUST P-SEAL:

1. Loosen P-Seal retainer bolts.
2. Force P-Seal retainer and P-Seal against head.
3. Tighten P-Seal retainer bolts.

### REPLACEMENT OF P-SEALS:

To replace worn or damaged P-Seal's

1. Remove P-Seal retainer bolts.
2. Remove P-Seal retainer and P-Seal.
3. Place new P-Seal on spigot.
4. Place P-Seal retainer over P-seal tail.
5. Replace P-Seal retainer bolts.
6. Force P-Seal retainer and P-Seal against gate head and tighten P-Seal retainer bolts.

## SLIDE/WEIR GATE INSTALLATION CHECK LIST AND INITIAL OPERATING INSTRUCTIONS

AFTER INSTALLING SLIDE GATE AND BEFORE INITIAL OPERATION CHECK THE FOLLOWING:

1. Check guide frame for proper alignment.
2. Check to make sure stem guides and brackets are properly installed and securely fastened.
3. Clean and lubricate stem threads.
4. Clean the gate slide, guides, seals and invert of all foreign material.
5. If P-seals are used, clean contact area and adjust seal.
6. Adjust stop nut to within 1/16" of the top of lift nut and lock in place.
7. Install stem cover if required.
8. If gate does not operate smoothly or shows excess leakage, see SLIDE GATE TROUBLE SHOOTING SECTION for remedy.

## SLIDE/WEIR GATE TROUBLE SHOOTING

<b><u>PROBLEM</u></b>	<b><u>REASON</u></b>	<b><u>SOLUTION</u></b>
HARD TO OPERATE	Warped or distorted guides	Loosen anchor bolt nuts, shim gate to true plane. Place non-shrink grout between guides and wall
	Foreign material in guide grooves	Remove foreign material from guide grooves.
	Dry or dirty stem threads	Clean thoroughly and grease with recommended lubricant
	Gates with dual stems: Head operating unevenly	Disconnect couplings on interconnecting shaft. Rotate hoist until gate head is level. Reconnect couplings.
LEAKAGE – SIDES	Guides warped or distorted	Loosen anchor bolt nuts, shim gate to true plane, place non-shrink grout between guides and wall
	Foreign material wedged between head and guide	Remove foreign material from guides
	P-seal out of adjustment	Loosen seal retainer bolts and force seal out until contact with head. Tighten bolts.
LEAKAGE – BOTTOM OF GATE	Foreign material on or around seal	Remove foreign material.
LEAKAGE – TOP OF GATE	Over tightening operator in closed position	Limit operator, force to 40 lbs of pull. Make sure stop nut is properly installed.

## EQUIPMENT MAINTENANCE

### GATES:

No maintenance other than periodic cleaning and operation of the sluice or slide gates is required. (Gates should be operated every three months.

### OPERATORS:

At least twice a year all grease fittings on manual operators should be lubricated with a small amount of heavy duty grease. (See lubrication chart)

### OPERATING STEMS:

To insure proper operation and life of operating stems and lift nuts, it is very IMPORTANT THAT OPERATING STEMS ARE CLEANED AND GREASED EVERY SIX MONTHS. To help keep stem and lift nuts clean, the use of stem covers are recommended.

(For recommended grease see lubrication chart)

### NON-RISING STEM GATES:

Because non-rising stem lift nuts are normally submerged in water or sewage, the stem threads may become coated with grit. This will cause excessive wear on stem threads and lift nut. Therefore, the following maintenance program is required:

1. The stem and lift nut must be kept clean and greased.
2. The lift nut should be removed once a year and inspected for wear. If excessive wear is evident the lift nut should be replaced.

## LUBRICATION

### OPERATORS:

At least twice a year all grease fittings on manual operators should be lubricated with a small amount of heavy duty grease. (See lubrication chart).

### OPERATING STEM:

To insure proper operation and life of operating stems and lift nuts, it is very **IMPORTANT THAT OPERATING STEMS ARE CLEANED AND GREASED EVERY SIX MONTHS**. To help keep stem and lift nuts clean, the use of stem covers are recommended. (For recommended grease see lubrication chart).

## LUBRICATION CHART

### OPERATORS:

Mobilgrease Special\*

Lubriplate #630-AA\*

Chevron R.M.P. Heavy Duty Grease EPNLGI2\*

Unocal Megaplex XD-2\*

### STEMS:

Lubriplate #630-2\*

Shell Alvania 2-EP\*

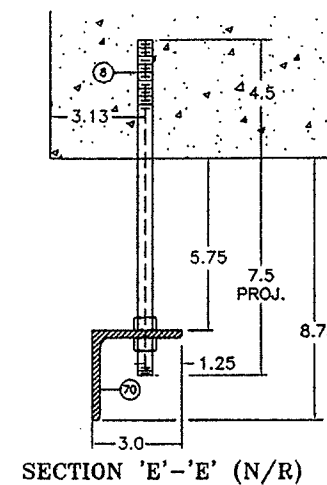
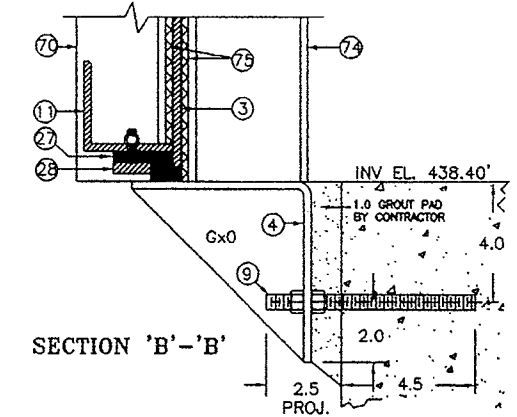
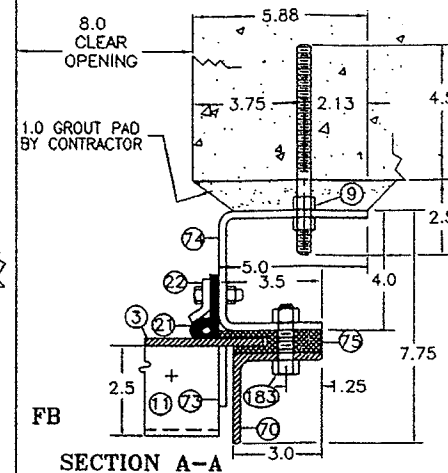
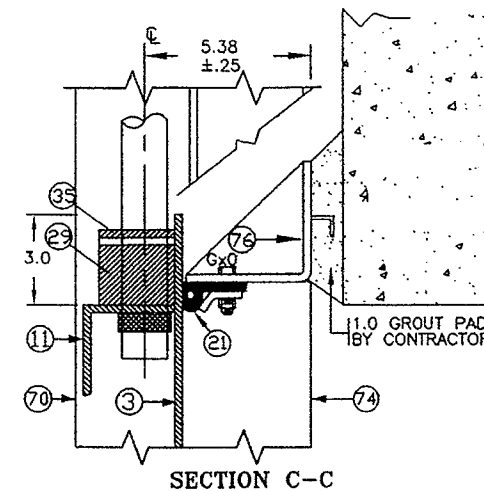
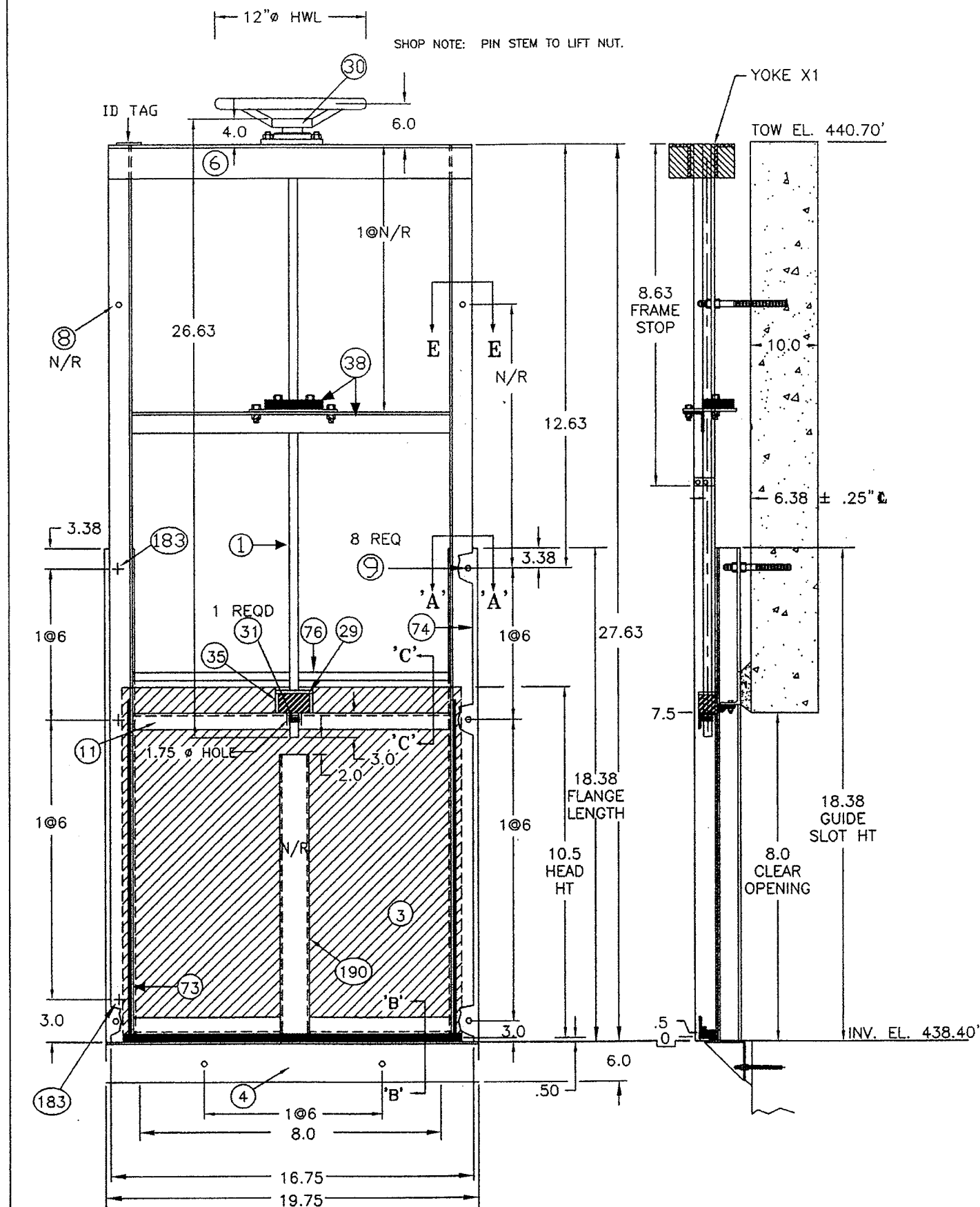
Mobilox 2-EP\*

Valvoline Val-Lith 2-EP\*

Chevron Ultra Duty Grease EP-2\*

Unocal Unoba EP-2\*

\*If food grade grease is required use high quality food grade grease intended for use in potable water



MD GH-46 STAINLESS STEEL SLUICE GATE MATERIAL LIST		
1	STEM	1" DIAMETER S-STL, W/L HAND ACME ROLLED THREADS, 16 MICRO IN. RMS OR LESS FINISH
3	GATE HEAD	1/4" S-STL PLATE
4	INV. MEMBER	6.0x6.0x1/4" FORMED S-STL ANGLE
6	YOKE	4.0 x 4.0 x 1/4" FORMED S-STL ANGLE
8	ANCHOR BLT	1/2x12.0 S-STL ANCHOR ROD, W/2 NUTS
9	ANCHOR BLT	1/2x7.0 S-STL ANCHOR ROD, W/2 NUTS
11	STIFFENER	1/4x2.5 S-STL FLAT BAR
21	P-BULB SEAL	NEOPRENE RUBBER
22	RETAINER	3/16" X 2" S-STL FLAT BAR, W/SLOTTED HOLES
27	INVERT SEAL	NEOPRENE RUBBER, PART# 7509
28	INV. SEAL RTNR	3/8" X 1 1/4" S-STL FLAT BAR
29	NRS STEM NUT	2.5x2.5x2.0 SQ BRONZE
30	OPERATOR	GH-1, NON-GEARED, HANDWHEEL, ANODIZED ALUMINUM HOUSING, MECH. SEALS ROLLER BEARING SUPPORTED BRONZE LIFT NUT, GREASE ZERK, OPEN DIRECTION ARROW
31	STOP NUTS	BRONZE
35	STEM POCKET	1/4" S-STL FLAT BAR
38	STEM GUIDE	2.0x2.0x1/4" S-STL ANGLE W/UHMW STEM GUIDE BUSHING
70	GUIDE RAIL	3.0x3.0x1/4" HR S-STL ANGLE
73	VERT. STIFF.	1/4" x 2.0 S-STL FLAT BAR
74	VERT. SPIGOT RAIL	5" x 4" x 3.5" x 1/4" FORMED S-STL CHANNEL
75	GUIDE BEARING BAR	UHMW POLYETHYLENE
76	HORIZONTAL SPIGOT	4 1/8" x 4" x 1/4" FORMED S-STL ANGLE
183	CLAMP BLT	1/2" x 2" S-STL HEX BOLT, W/NUT & F/W
190	VERTICAL STIFFENER N/R	3.0x2.5x2.5 FORMED CHANNEL

\* ANCHOR BOLTS ARE DESIGNED FOR USE WITH EPCON A-7 ADHESIVE INJECTION SYSTEM OR EQUAL (ADHESIVE BY CONTRACTOR)

MATERIAL SPECIFICATIONS:  
 HARDWARE & FASTENERS = TYPE 304 SS ASTM-F593 / F594  
 S-STL FORMED & PLATE = 304L SS ASTM-A240  
 S-STL HR & FLAT BAR SHAPES = TYPE 304L SS ASTM-A276  
 S-STL STEM = TYPE 304 SS ASTM-A276  
 S-STL ANCHOR ROD = TYPE 304 SS ASTM-A276  
 UHMWPE = ASTM-D1248  
 NEOPRENE RUBBER = ASTM-D2000  
 BRONZE = ASTM-B584

GOLDEN HARVEST  
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Max Seating Head = 9.0 Ft.		Max Unseating Head = 9.0 Ft.	
Max Operating Head = 9.0 Ft.		Measured From GATE INVERT	
8 x 8		96" COMBINED OVERFLOW STRUCTURE	
MD GH-46-NRS		GOLDEN HARVEST	
WALL MTD		GOLDEN GATES	
SS SLIDE GATE		1-800-338-6238	
P.O. BOX 287 Burlington, WA 98233		1 - REQ'D	
Project Description:		Date Drawn: 8-14-07	
DNR & PARKS		Revision:	
For:		Revision:	
RENTON, WA		Revision:	
Contractor:		G.H. Drawing #: 1 OF 2	
KING COUNTY		Contract Sht #: C7	
Engineer:		Scale: Job No.: NTS 07-0780	
Drawn By: KH		FL = 16	

11/12/08

## **Appendix C**

### **Turf Mat Specifications**

- D. Product Certification for Nonwoven Construction Geotextile
1. The Contractor shall submit to the Project Representative the Manufacturer's Certificates of compliance with the following information regarding each geotextile proposed for use:
    - a. Manufacturer's name and current address
    - b. Full product name
    - c. Geotextile structure, including fiber/yarn type
    - d. Roll width and length
    - e. Geotextile roll number
    - f. Certified test results.

## PART 2 PRODUCTS

### 2.01 GEOTEXTILE

- A. NONWOVEN CONSTRUCTION GEOTEXTILE:
- Geotextile consisting only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. The geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation. The geotextile shall conform to the minimum average roll properties as indicated in the table below.

Property	Test Method	Requirement
AOS	ASTM D 4751	0.25 mm max
Water permittivity	ASTM D 4491	0.2 sec-1 min.
Grab Tensile Strength, min. in machine and x-machine direction.	ASTM D 4632	160 lbs min.
Seam Breaking Strength	ASTM D 4632	140 lbs min.
Burst Strength	ASTM D 3786	190 psi min.
Puncture Resistance	ASTM D 4833	50 lbs min
Tear Strength, min. in machine and x-machine direction.		
Ultraviolet (UV) radiation stability	ASTM D 4355	70% strength retained min., after 500 hrs.

Thread used for sewing shall consist of high strength polypropylene, polyester, or polyamide. Nylon threads will not be allowed. The thread shall be of contrasting color to that of the geotextile itself.

B. FILTER FABRIC FOR TEMPORARY SILT FENCING:

Property	Test Method	Requirement
AOS	ASTM D 4751	#100 sieve (min) to #50 sieve (max)
Permittivity	ASTM D 4491	0.02 sec-1 min.
Tensile Strength	ASTM D 4632	180 lbs min. in machine direction. 100 lbs min. in x-machine direction
Failure Strain	ASTM D 4632	30% max. at 180 lbs or more
Ultraviolet (UV) radiation stability	ASTM D 4355	70% strength retained min., after 500 hrs.

C. ACCEPTABLE MANUFACTURERS:

1. Mirafi
2. Synthetic Industries
3. Approved equal

2.02 Turf Reinforcement Mat (TRM)

- A. TRM shall consist of a permanent, three-dimensional, turf reinforcement matting consisting of ultraviolet (UV) stabilized polymer netting designed and manufactured for the specific application of permanent reinforcement of turf in channel applications.

B. TRM Required Properties:

Property	Test Method	Minimum Average Roll Value
UV Resistance at 3000 hours	ASTM D-4355	80%
Thickness	ASTM D-1777	0.5 inches

C. TRM Required Performance Criteria:

Performance	Maximum Permissible Values (product must meet or exceed the values presented)	
Velocity	Short-Term (1/2 hour)	Long-Term (50 hours)
Vegetated	20 ft/sec	11 ft/sec
Unvegetated	10 ft/sec	NA
Shear Stress	Short-Term (1/2 hour)	Long-Term (50 hours)
Vegetated	11 lb/ft <sup>2</sup>	6 lb/ft <sup>2</sup>
Unvegetated	6 lb/ft <sup>2</sup>	NA

D. Acceptable Products:

1. North American Green C350 Vmax<sup>3</sup>
2. North American Green P550 Vmax<sup>3</sup>
3. Synthetic Industries Pyramat®
4. Or approved equivalent. Products submitted for consideration as an equivalent TRM must have been tested by the Texas Transportation Institute (TTI) Hydraulics and Erosion Control Laboratory, be included on the Texas Department of Transportation Approved Product List (APL), and have property and performance values that meet or exceed the requirements of this specification.

## PART 3 EXECUTION

### 3.01 TRM INSTALLATION

- A. Prior to placing TRM on the spillway channel, the channel slope shall be constructed and key trenches excavated to the lines and grades shown on the drawings.
- B. The uppermost 12 inches of embankment soil that will be below the TRM shall consist of a mixture of 85 percent (by weight) Type C1 and C2 screen native material and 15 percent (by weight) Topsoil. This material shall be compacted to a minimum of 90 percent of its modified proctor dry density. The face of the slope shall be cleared of all rocks, dirt clods, vegetation, trash and other obstructions that may cause the TRM to bridge the ground surface.
- C. Prior to placing the TRM, the ground surface to be covered by the TRM shall be hydroseeded using the standard erosion control hydroseed mix specified in Section 02270 applied at a minimum rate of 0.2 oz./yd<sup>2</sup>. Lime and fertilizer shall be applied as specified in Section 02270.
- D. The TRM shall be unrolled starting from the top of the slope with the flat side against the ground. Where the TRM is spliced in the direction of flow, upslope panels shall shingle over the top of downslope panels. Adjacent TRM panels shall overlap the minimum distances shown on the drawings. TRM shall be anchored in the key trenches as shown on the drawings.
- E. Heavy duty steel pins, steel staples, or polyethylene pegs shall be used to anchor the TRM in key trenches and to the slope face as shown in the Plans. Where the TRM bridges undulations in the ground surface or would otherwise not be in contact with the ground surface, additional pins or pegs shall be added, at no additional cost to King County. Steel pins shall be 0.2 inch minimum diameter with a 1.5 inch diameter steel washer secured at the head of the pin. Steel staples shall be U-shaped, consist of 0.12 inch minimum diameter galvanized steel wire, and have minimum dimensions of 12 inches by 1 inch (at base of "U") by 12 inches. Polyethylene pegs shall be "T" type or have a 1.5 inch diameter washer secured at the head of the peg. All pins, staples, or pegs shall be a minimum of 12 inches long.
- F. Backfill key trenches and compact key trench backfill after installing pins and pegs.
- G. Successful full vegetation establishment shall be measured as greater than 75 percent vegetation density, expressed as the average percent of vegetative cover measured at three months after hydroseed and TRM application and measured again at the end of the warranty period. If vegetative cover does not meet this criteria at either 3 months or at the end of the warranty period in any 3-foot by 3-foot square surface area within the limits of the TRM, the contractor shall apply additional seed, hydroseed, topsoil, mulch, lime, and fertilizer as necessary to the areas with insufficient vegetation to produce the specified vegetation density.

### 3.02 NONWOVEN GEOTEXTILE:

- A. The area to be covered by the geotextile shall be graded to a smooth, uniform condition free from ruts, potholes, and protruding objects such as rocks or sticks. The geotextile shall be spread immediately ahead of the covering operation. The geotextile shall not be left exposed to sunlight during installation for a total of more than 14 calendar days. The geotextile shall be laid smooth without excessive wrinkles. Under no circumstances shall the geotextile be dragged through mud or over sharp objects which could damage the geotextile. Should the geotextile be torn punctured, or the overlaps or sewn joints disturbed, as evidenced by visible geotextile damage, subgrade pumping or distortion, or intrusion, the geotextile around the damaged or displaced area shall be exposed and the damaged area repaired or replaced by the Contractor at no expense to the Contracting Agency. The repair shall consist of a patch of the same type of geotextile placed over the damaged area. The patch shall overlap the existing geotextile from the edge of any part of the damaged area by the minimum required overlap for the application.
- B. The geotextile shall either be overlapped a minimum of 2 ft at all longitudinal and transverse joints, or the geotextile joints shall be sewn together. If overlapped, the geotextile shall be placed so that the upstream strip of geotextile will overlap the next downstream strip. When placed on slopes, each strip shall overlap the next downhill strip.
- C. If geotextile seams are to be sewn in the field or at the factory, the seams shall consist of one row of stitching unless the geotextile where the seam is to be sewn does not have a selvage edge. If a selvage edge is not present, the seams shall consist of two parallel rows of stitching, or shall consist of a J-seam, Type SSn-1, using a single row of stitching. The two rows of stitching shall be 1 inch apart with a tolerance of 0.5 inches and shall not cross except for re-stitching. The stitching shall be a lock-type stitch. The minimum seam allowance, i.e., the minimum distance from the geotextile edge to the stitch line nearest to that edge, shall be 1.5 inches if a flat or prayer seam, Type SSa-2, is used. The minimum seam allowance for all other seam types shall be 1 inch. The seam, stitch type, and the equipment used to perform the stitching shall be as recommended by the manufacturer of the geotextile and as approved by the Engineer. The seams shall be sewn in such a manner that the seam can be inspected readily by the Project Representative. The seam strength will be tested and shall meet the requirements of Section 10-6. Placement of gabions, gabion mattresses, or riprap on the geotextile shall start at the toe of the slope and proceed upwards. All voids in the riprap that allow the geotextile to be visible shall be backfilled with quarry spalls or other small stones, as designated by the Engineer, so that the geotextile is completely covered.
- D. Grading of slopes after placement of the riprap will not be allowed if grading results in stone movement directly on the geotextile. Under no circumstances shall stones with a weight of more than 100 lbs be allowed to roll downslope. Stones shall not be dropped from a height greater than 1 ft above the geotextile surface. Lower drop heights may be required if geotextile damage from the stones is evident, as determined by the Project Representative.

### 3.03 TESTING

- A. Geotextiles and TRM shall be tested in accordance with the requirements of the standards referenced above.
- B. TRM performance test results shall be obtained through third party testing at the Texas Transportation Institute, Colorado State University, and Utah State University based on soil loss failure criteria not exceeding 0.5 inches for the specified flow duration.

**END OF SECTION**



## C350 outperforms 12" riprap

### Background:

A channel located in Monroe County, Iowa, along County Highway S-65, will convey flows from numerous storm events resulting in high shear stress and flow velocities. The channel was initially designed to provide a drainage system for runoff from the highway and 150 acres of surrounding agricultural land. Unreinforced vegetation had been employed as the primary lining for this channel but had proven to be unsuccessful, resulting in severe erosion, channel scour and large amounts of sediment being removed from the site.

### Problem:

Previous attempts at using unreinforced vegetation for the channel liner had failed, but did provide useful insight of the three specific problems needing to be counteracted by the permanent erosion control method.

The channel along S-65 would be exposed to extended duration (up to 12 hours) and high shear stress flow events (channel discharges of 20 cubic feet per second [cfs]). Secondly, the erosion control measures must provide protection with the presence of an almost continuous flow occurring in the bottom of the channel. Finally, diversion of drainage from across S-65, via a large culvert box, into this channel would result in large volumes of water entering the channel at a 45° angle. The ensuing turbulence and increased shear forces would further propagate scour action along portions of the channel lining.

### Solution:

Since no easy and economical solution was readily apparent for solving the diversity of problems, a team was developed consisting of an assorted group of professionals (i.e. engineer, erosion control and wetland plants specialist) to analyze the design and determine the best course of action. Initially the project engineer felt that 12" rock riprap would be required to control the erosive forces that would potentially impact the channel, but the installation costs of this option were prohibitive. North American Green's Erosion Control Materials Design Software, Version III, was used to analyze this channel under a 20 cfs flow event to determine the type of erosion protection that would provide a cost effective, aesthetically pleasing and environmentally friendly option.

The subsequent analysis determined that North American Green C350 Erosion Control / Turf Reinforcement Mat was the appropriate channel

lining material for both performance and economic reasons over 12" rock riprap (see Tables 1 and 2). The software allowed the project engineer to analyze the 20 cfs design flow event through all three developmental phases of the reinforced vegetation channel lining. Examination of the channel flow parameters determined that C350, with its coconut fibers present, would provide the necessary immediate (unvegetated) erosion protection against the continuous discharge present in the channel (see Table 1). Furthermore, the C350's permanent net structure would provide continued erosion control and vegetation reinforcement (see Table 2). The final vegetative stand for this site was best defined as a retardance Class B (12-24 inches in height) according to the Federal Highway Administration's Hydraulic Engineering Circular #15 (FHWA, HEC-15).

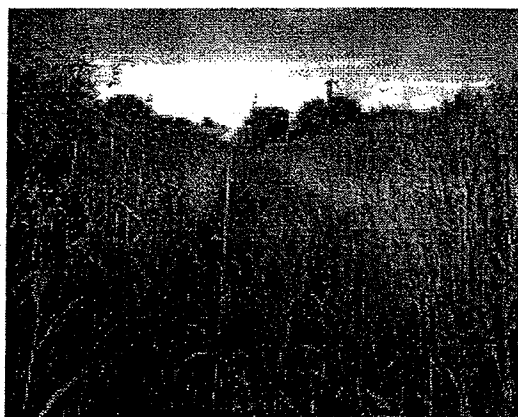
The C350's coconut fibers also functioned as an excellent mulch material and resulted in more rapid vegetation establishment in the channel. Budgeting constraints required that only the bottom and portions of the side slopes of the channel be covered by C350. Comparison of unprotected areas of the channel and those portions where C350 had been installed revealed that the C350 promoted a denser stand of vegetation and a more rapid rate of vegetation establishment (see Photo 3).



## Results:

The C350 was installed immediately after channel construction activities (see Photo 1) and was partially vegetated when a number of massive storm events resulted in numerous high discharge flow events taking place in the channel prior to vegetation establishment. The C350 reinforced immature vegetation provided effective erosion protection for this channel as was apparent when the flows dissipated and there were no visible signs of soil loss or rilling under the matting (see Photo 2).

The saturated soils in the channel, due to continuous flow occurring from the onset of the project, provided some of the best conditions for channel scour to occur. The continuous flow would also test the immediate erosion control capabilities of the unvegetated C350. The C350 worked excellent and did not allow erosion or loss of seed as was apparent by a thick dense stand of vegetation shortly after installation.



North American Green Channel Protection User Specified Channel Lining Analysis					
	Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft / ft)	
	12.00	3.0	3.0	0.100	
Discharge (cfs)	Peak Flow - Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic	Normal Depth (ft)
20.0	12.0	5.07	3.95	0.28	.31
Lining Type	Manning Coefficient	Permissible Shear (lbs/sf)	Calculated Shear (lbs/sf)	Safety Factor	Remark
C350 Staple E Phase 1 (unveg.)	0.040	2.25	1.91	1.18	Stable

A small section of 12" rock riprap was also designed and installed to protect a portion of the channel where flows would produce high shear stress conditions. Surprisingly, unlike the reinforced vegetative sections, this area of the channel experienced severe erosion, resulting in the formation of large scour holes. A majority of the 12" rock riprap was moved downstream from its initial location causing complete failure of the rock section (see Photo 4) under the same flow conditions negated by the C350 reinforced vegetation.



North American Green Channel Protection User Specified Channel Lining Analysis					
	Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft / ft)	
	12.00	3.0	3.0	0.100	
Discharge (cfs)	Peak Flow - Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic	Normal Depth (ft)
20.0	12.0	2.42	8.25	0.52	.60
Lining Type	Manning Coefficient	Permissible Shear (lbs/sf)	Calculated Shear (lbs/sf)	Safety Factor	Remark
C350 Staple E Phase 3 Class B	0.126	Veg 5.73 Clay Loam 1.000	3.73 0.046	1.54 21.78	Stable Stable

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## Channel Testing - TTI Test Results

Texas Transportation Institute (TTI) conducts performance testing on North American Green rolled erosion control products (RECPs) for the Texas Department of Transportation (TXDOT).

Since its inception in 1993 extensive testing has been conducted on various North American Green products at the Texas Transportation Institute (TTI) to determine acceptance for the Texas Department of Transportation (TXDOT). All materials contained in this section are derived from the publication Final Performance Analysis Through The 2000 Evaluation Cycle Slope Protection Products, Flexible Channel Liner Products & Hydraulic Mulches co-authored by Paul Northcutt and Jett McFalls ([www.dot.state.tx.us/insdtdot/orgchart/cmd/erosion/sect1a.htm](http://www.dot.state.tx.us/insdtdot/orgchart/cmd/erosion/sect1a.htm)). The testing conducted by TTI is driven by the TXDOTs conversion from a material-type to an approved products specification, based on the performance of erosion control materials from TTI's erosion control research.

TXDOT has defined specific performance factors that must be met prior to acceptance of the erosion control product for use on DOT construction or maintenance activities. The performance factors that are evaluated at TTI include:

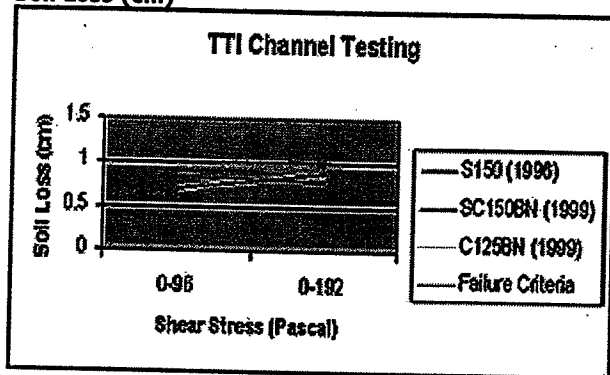
1. The effectiveness of an erosion control product at protecting the seedbed of an embankment from soil loss during simulated rainfall and runoff.
2. The effectiveness of an erosion control product at promoting vegetation establishment in a single growing season (Mar. - Dec.).

### "Flexible Channel Liner" testing protocol.

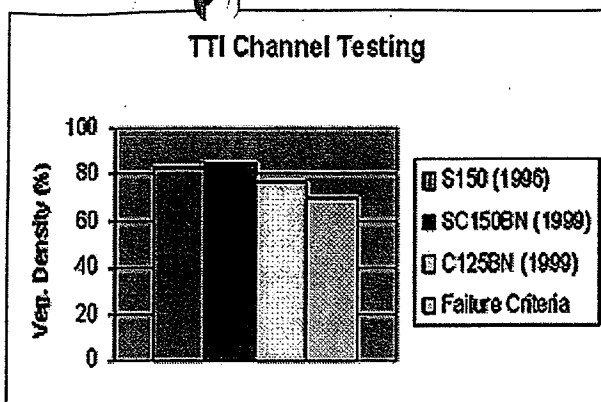
Products testing in this category is conducted on channels with bedslope centerline-gradients of either 3% (produce shear stresses up to 192 Pascal (4 lbs/ft<sup>2</sup>)) or 7% (produce shear stresses up to 383 Pascal (8 lbs/ft<sup>2</sup>)). Prior to any channel testing and product installation the Manning's "n" is determined for each product through the use of an indoor flume. After the hydraulic roughness is determined, each flume is seeded and the products are installed according to the manufacturer published installation instructions. After installation, each flume is allowed a 90-day resting period to allow vegetation establishment. After the 90-days the flumes are exposed to a series of increased shear stress flows or until product failure is determined due to soil loss. After each flow, measurements are taken and recorded to determine the soil displaced and for any physical product movement. The average soil displacement is determined and expressed in centimeters. The channels are also sampled to determine vegetative growth through the growing season (March - December). For more precise specifics on Flexible Channel Liner Testing conducted at TTI reference the Final Performance document noted in the TTI web site above.

### Channel Test Data from the Texas Transportation Institute (TTI) for North American Green Erosion Control Blankets.

Soil Loss (cm)

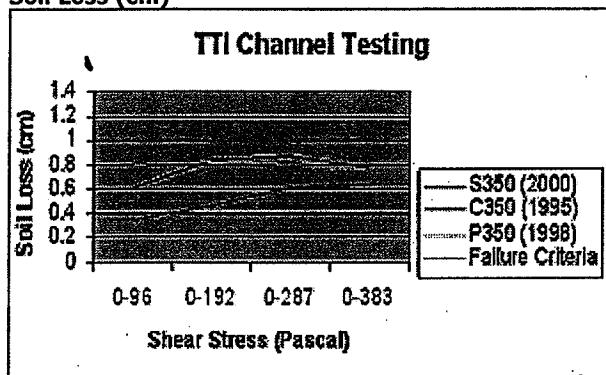


Vegetation Density (%)

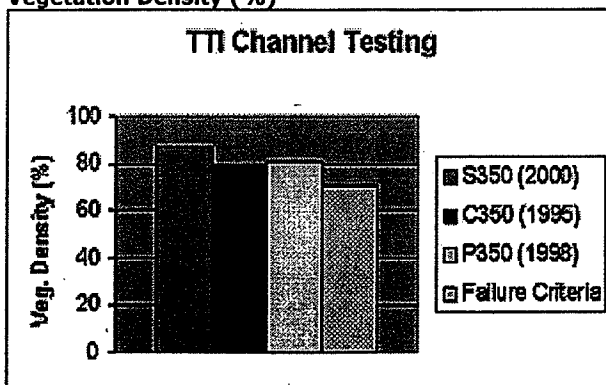


Channel Test Data from the Texas Transportation Institute (TTI) for North American Green Turf Reinforcement Matting.

**Soil Loss (cm)**



**Vegetation Density (%)**



**NOTE:**

1. The North American Green S350 is currently marketed under the SC250 trade name.
2. The North American Green P350 is currently marketed under the P550 trade name.

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## RESEARCH & DEVELOPMENT

### Channel Testing - Utah State University

#### Channel Liner Testing Protocol:

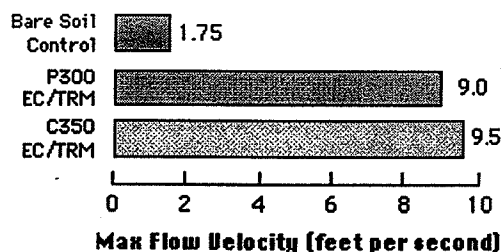
This university study utilized indoor laboratory channel flumes filled with highly erodible sandy loam soil and controlled volume flow events. Each channel lining material was subjected to consecutive 0.5 hour or longer flow events until erosion and/or a material failure occurred. Failure within the testing regimes was defined for the different lining materials as:

TEST MATERIAL	EROSION FAILURE	MATERIAL FAILURE
Bare Soil Control	0.5 in average soil loss from channel	N/A
Unvegetated Matting	0.5 in average soil loss from channel	Observed tears, rips, or excess fiber loss
Unreinforced 6" Bluegrass Sod	0.5 in average soil loss from channel	Observed tears, scoured out holes
Reinforced 6" Bluegrass	0.5 in average soil loss from channel	Observed tears, scoured out holes

#### Phase 1

Phase 1 is the pre-emergence phase or immediate erosion control provided, consisting of the time period between seed application and seed germination and emergence. This phase requires effective erosion control and mulching to protect the seed and soil and enhance seed germination. Typically, the TRM selected for use will provide the sole means of erosion control during this developmental phase.

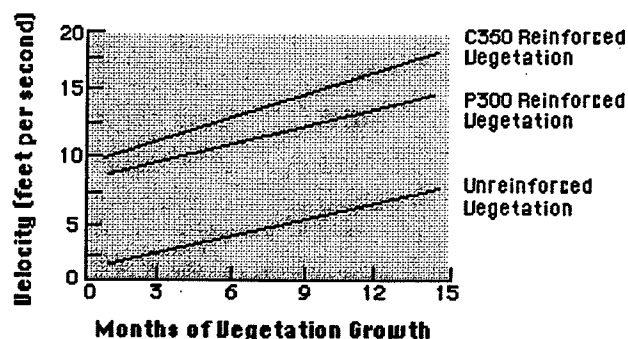
Maximum velocity for unvegetated mattings at 0.5 inch soil loss



#### Phase 2

Phase 2 occurs after seed germination and emergence and continues until the plants become full mature or established. There is a continued need for the TRM to provide erosion control at the base of the seedlings and for the interstitial soil surfaces between plants. The TRM must also provide structural support and reinforcement to prevent the plants with their undeveloped root and vegetative structures from being plucked from the soil.

Estimated permissible velocities for natural and reinforced Kentucky bluegrass



ECTC Research Guidelines

Channel Testing

Slope Testing

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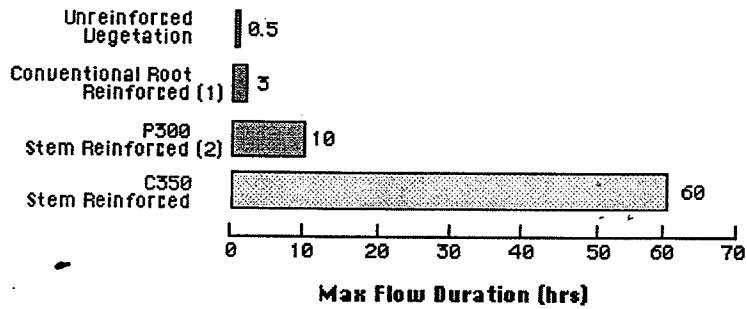
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**Phase 3**

Phase 3 is that period when the vegetation matures and becomes fully established.

Maximum flow durations for reinforced and unreinforced mature vegetation at 18 feet per second velocity

1. Conventional Root Reinforcement Turf Data from other Manufacturers published data
2. P300 limit reached following at 60 hr flow at 14.5 fps



[« Back to Channel Testing](#)



## MATERIAL SPECIFICATION

### C350

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra-heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

The C350 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.18* as a Type 5A, B, and C Permanent Turf Reinforcement Mat.

Installation staple patterns shall be clearly marked on the turf reinforcement matting with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The composite turf reinforcement mat shall be the North American Green C350, or equivalent. The C350 permanent composite turf reinforcement mat shall have the following physical properties:

#### Material Content

Matrix	100% Coconut Fiber (0.50 lb/yd <sup>2</sup> ) (0.27 kg/m <sup>2</sup> )
Nettings	Top – Super Heavy Duty UV Stabilized Polypropylene 8.00 lbs/1,000 ft <sup>2</sup> (3.91 kg/100 m <sup>2</sup> )  Mid – Corrugated Ultra-Heavy Duty UV Stabilized Polypropylene 24 lb/1,000 ft <sup>2</sup> (11.7 kg/100 m <sup>2</sup> )  Bottom – Super Heavy Duty UV Stabilized Polypropylene 8.00 lbs/1,000 ft <sup>2</sup> (3.91 kg/100 m <sup>2</sup> )
Thread	UV Stabilized Polypropylene

#### C350 is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width	6.50 ft (2.00 m)
Length	55.50 ft (16.90 m)
Weight ± 10%	37.00 lbs (16.80 kg)
Area	40.00 yd <sup>2</sup> (33.40 m <sup>2</sup> )

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)



## SUPPLEMENTAL SPECIFICATION

# C350

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, a ultra heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

<u>Property</u>	<u>Test Method</u>	<u>Typical</u>
Thickness	ASTMD6525	0.67 in (17 mm)
Resiliency	ASTMD1777	90%
Density	ASTMD792	0.528 oz/in <sup>3</sup> (0.913 g/cm <sup>3</sup> )
Mass per Unit Area	ASTMD6566	12.57 yd <sup>2</sup> (426 g/m <sup>2</sup> )
Porosity	ECTC Guidelines	99%
Stiffness	ASTMD1388/ECTC	3.83 oz-in (42,710 mg-cm)
Light Penetration	ECTC Guidelines	9.0%
MD Tensile Strength	ASTMD6818 [D5035]	625 lbs/ft (9.12 kN/m) [658 lbs/ft (9.60 kN/m)]
MD Elongation	ASTMD6818 [D5035]	22% [8.50%]
TD Tensile Strength	ASTMD6818 [D5035]	768 lbs/ft (11.21 kN/m) [910 lbs/ft (13.28 kN/m)]
TD Elongation	ASTMD6818 [D5035]	15% [10.90%]

### C350 PERMANENT TURF REINFORCEMENT MATTING ONLY

<u>Property</u>	<u>Test Method</u>	<u>Typical</u>
Thickness	ASTM D6525	0.51 in (13 mm)
UV Stability	ASTM D4355*	86%
MD Tensile Strength	ASTM D6818 [D5035]	698 lbs/ft (10.19 kN/m) [564 lbs/ft (8.23 kN/m)]
MD Elongation	ASTM D6818 [D5035]	30% [37%]
TD Tensile Strength	ASTM D6818 [D5035]	710 lbs/ft (10.36 kN/m) [780 lbs/ft (11.38)]
TD Elongation	ASTM D6818 [D5035]	20%

\*ASTM D1682 (4 inch strip) Tensile Strength and % Strength Retention of material following 1000 hrs exposure in Xenon-Arc Weatherometer; MD – Machine direction; TD – Transverse direction

### Bench Scale Testing<sup>†</sup>

<u>Test Method - Description</u>	<u>Parameters</u>	<u>Results</u>
ECTC Method 2 – Determination of unvegetated RECP's ability to protect soil from rain splash and associated runoff	50 mm (2 in)/hr for 30 min	Soil loss ratio* = 18.32
	100 mm (4 in)/hr for 30 min	Soil loss ratio* = 19.65
	150 mm (6 in)/hr for 30 min	Soil loss ratio* = 20.48
ECTC Method 3 – Determination of unvegetated RECP's ability to protect soil from hydraulically-induced shear stress. Failure criteria = 0.50 inch soil loss	Shear: 4.72 lbs/ft <sup>2</sup> for 30 min	Soil loss: 127g
	Shear: 5.74 lbs/ft <sup>2</sup> for 30 min	Soil loss: 195g
	Shear: 5.91 lbs/ft <sup>2</sup> for 30 min	Soil loss: 255g
	Shear at 0.50 inch soil loss (450g)	7.5 lbs/ft <sup>2</sup>
ECTC Draft Method 4 – Determination of temporary RECP performance in encouraging seed germination and plant growth	Top soil; Fescue (Kentucky 31); 21 day incubation 27° C ± 2° & approximately 50% RH	Percent improvement = 243% (increased biomass)
* Soil Loss Ratio = Soil Loss with Bare Soil / Soil Loss with RECP (NOTE: Soil loss based on regression analysis)		

### <sup>†</sup>Bench Scale Performance Testing

Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

Updated 1/2004



## PERFORMANCE SPECIFICATION

### C350

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, a ultra duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

#### Slope Design Data

Slope Length (L)	Slope Gradient (S)		
	≤ 3:1	3:1-2:1	≥ 2:1
≤ 20 ft (6 m)	0.0005	0.015	0.043
20 – 50 ft	0.018	0.031	0.050
≥ 50 ft (15.2 m)	0.035	0.047	0.057

#### Channel Design Data

Roughness Coefficients	
Flow Depth	Manning's 'n'
≤ 0.50 ft (0.15 m)	0.041
0.50 – 2.00 ft	0.040-0.013
≥ 2.00 ft (0.60 m)	0.012

Values are approximate, precise values obtained from ECMDS™

Maximum Permissible Shear Stress*		
	Short Duration	Long Duration
Phase 1 UNVEGETATED	3.20 lbs/ft <sup>2</sup> (153 Pa)	3.00 lbs/ft <sup>2</sup> (144 Pa)
Phase 2 PARTIALLY VEGETATED	10.00 lbs/ft <sup>2</sup> (480 Pa)	10.00 lbs/ft <sup>2</sup> (480 Pa)
Phase 3 FULLY VEGETATED	12.00 lbs/ft <sup>2</sup> (576 Pa)	10.00 lbs/ft <sup>2</sup> (480 Pa)

#### Approximate Maximum Flow Velocity

Unvegetated = 10.5 ft/s (3.20 m/s)

Vegetated = 20 ft/s (6.0 m/s)

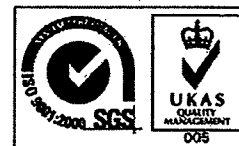
\*Performance values obtained through third party testing at the Texas Transportation Institute, Colorado State University, and Utah State University based on soil loss failure criteria not exceeding 0.50 inches (1.27 cm).

Updated 1/2004

# TENAX MULTIMAT

Type: **100**

Geomat



TENAX **MULTIMAT** are polypropylene erosion control geomats, designed for protection and growing of grass on slopes subject to surface erosion. TENAX **MULTIMAT** are three dimensional mats composed by extruded and bioriented polypropylene grids, laid one upon each another and tied up by means of a black polypropylene yarn. The three dimensional structure of the mat shelters the layer of top soil and anchors the growing roots of the planted seeds, so to obtain one block very resistant to the rain drop run off and soil movement. TENAX **MULTIMAT** can be easily installed and it does not require skilled personnel.

## Typical applications

Roadway ditches; slope protection; storm and irrigation channels; lakes banks; landfill cover.

PHYSICAL CHARACTERISTICS	TEST METHOD	UNIT	MULTIMAT 100	NOTES
STRUCTURE			THREE DIMENSIONAL GEOMAT COMPOSED BY 3 LAYERS	
MESH TYPE			RECTANGULAR APERTURES	
STANDARD COLOR			BLACK	
POLYMER TYPE			POLYPROPYLENE	
CARBON BLACK CONTENT	ASTM D1603		1.0%	
PACKAGING	ISO 10320		ROLLS WITH IDENTIFICATION LABEL	

DIMENSIONAL CHARACTERISTICS	TEST METHOD	UNIT	MULTIMAT 100	NOTES
APERTURE SIZE MD		mm	12.0	b,c
APERTURE SIZE TD		mm	16.0	b,c
THICKNESS	ISO 9863	mm	17.0	b
MASS PER UNIT AREA	ISO 9864	g/m <sup>2</sup>	320	b
ROLL WIDTH		m	2.20	b
ROLL LENGTH		m	30.0	b
ROLL DIAMETER		m	0.78	b
ROLL VOLUME		m <sup>3</sup>	1.40	b
GROSS ROLL WEIGHT		kg	24.0	b

TECHNICAL CHARACTERISTICS	TEST METHOD	UNIT	MULTIMAT 100		NOTES
			MD	TD	
PEAK TENSILE STRENGTH	ISO 10319	kN/m	10.0	15.0	a,c
YIELD POINT ELONGATION	ISO 10319	%	20.0	15.0	b,c

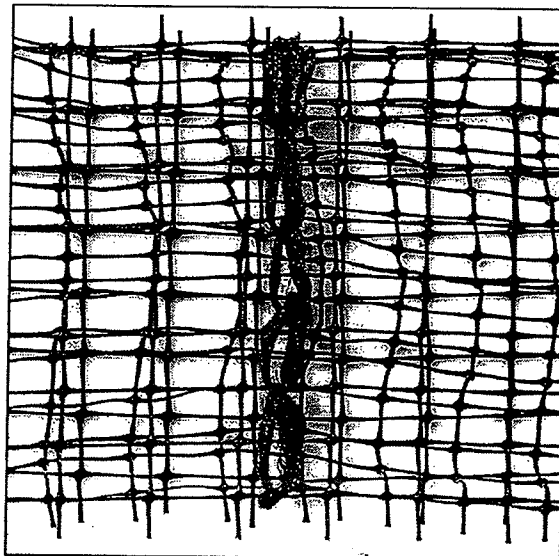
### NOTES:

- a) 95% lower confidence limit values, ISO 2602
- b) Typical values
- c) MD : machine direction (longitudinal to the roll)  
TD : transverse direction (across roll width)

**TENAX**<sup>®</sup>  
Man, Technology, Environment.

## Typical Characteristics

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## TENAX MULTIMAT 100



0799-CPD-25

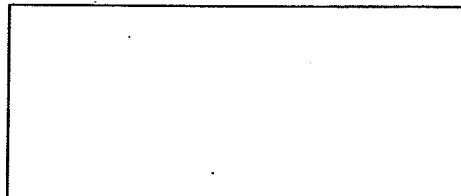


The TENAX Laboratory has been created in 1980 and has been continuously improved with the purpose of assuring unequalled technical development of the products and accurate Quality Control.

The TENAX Laboratory can perform mechanical, hydraulic and durability tests, according to the most important international standards like ISO, CEN, ASTM, DIN, BSI, UNI.

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**TENAX®**  
Man, Technology, Environment.

## PYRAMAT®

PYRAMAT is manufactured at one of SI Corporation's facilities that has achieved ISO-9002 certification for its systematic approach to quality. PYRAMAT High Performance Turf Reinforcement Mat (HPTRM) is a three-dimensional, lofty, woven polypropylene geotextile which is specially designed for erosion control applications on steep slopes and vegetated waterways. The matrix, which is available in green or tan, is composed of polypropylene monofilament yarns woven into a uniform configuration of resilient pyramid-like projections. The material exhibits very high interlock and reinforcement capacity with both soil and root systems, and demonstrates high tensile modulus. The HPTRM conforms to the property values listed below<sup>1</sup> that have been derived from quality control testing performed by one of SI Corporation's GAI-LAP accredited laboratories:

### MARV<sup>2</sup>

PROPERTY	TEST METHOD	ENGLISH	METRIC
<b>Physical</b>			
Mass/Unit Area	ASTM D6566	14.0 oz/yd <sup>2</sup>	475 g/m <sup>2</sup>
Thickness	ASTM D6525	0.50 in	12.7 mm
Light Penetration (% Passing)	ASTM D6567	25%	25%
Color	-	Green, Tan	
<b>Mechanical</b>			
Tensile Strength	ASTM D6818	3,100 x 2,000 lb/ft	45.2 x 29.2 kN/m
Tensile Elongation	ASTM D6818	55% (max)	55% (max)
Resiliency	ASTM D6524	80%	80%
Flexibility	ASTM D6575	0.640 in-lbs (avg)	736,000 mg-cm (avg)
<b>Durability</b>			
UV Resistance @ 3000 hrs	ASTM D4355	90%	90%
<b>Performance</b>			
Shear Stress <sup>3</sup>	Large Scale	12 lb/ft <sup>2</sup>	574 Pa
Manning's "n" <sup>4</sup>	Calculated	0.021	0.021
Seedling Emergence <sup>5</sup>	ECTC Draft Method #4	—	—
<b>Roll Size</b>			
		8.5 ft x 90 ft	2.59 m x 27.4 m

### NOTES

1. The property values listed are effective 3/01/2004 and are subject to change without notice.
2. MARV indicates the minimum average roll value calculated as the average minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will meet or exceed the reported value.
3. Maximum permissible shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact SI Geosolutions for further information.
4. Calculated as average values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches. Contact SI Geosolutions for Manning's "n" values for flow depths greater than 12 inches.
5. To Be Determined - Calculated as the average plant height obtained with tall fescue grass seed in sand 14 days after seeding.

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT FURNISHED HEREUNDER OTHER THAN AT THE TIME OF DELIVERY IT SHALL BE OF THE QUALITY AND SPECIFICATION STATED HEREIN. ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS EXPRESSLY EXCLUDED, AND, TO THE EXTENT THAT IT IS CONTRARY TO THE FOREGOING SENTENCE, ANY IMPLIED WARRANTY OF MERCHANTABILITY IS EXPRESSLY EXCLUDED. ANY RECOMMENDATIONS MADE BY SELLER CONCERNING THE USES OR APPLICATIONS OF SAID PRODUCT ARE BELIEVED RELIABLE AND SELLER MAKES NO WARRANTY OF RESULTS TO BE OBTAINED. IF THE PRODUCT DOES NOT MEET SI GEOSOLUTIONS' CURRENT PUBLISHED SPECIFICATIONS, AND THE CUSTOMER GIVES NOTICE TO SI GEOSOLUTIONS BEFORE INSTALLING THE PRODUCT, THEN SI GEOSOLUTIONS WILL REPLACE THE PRODUCT WITHOUT CHARGE OR REFUND THE PURCHASE PRICE.

**Turf Reinforcement Mat Property Table – English Values<sup>1</sup>**

PROPERTY	TEST METHOD	UNIT	VALUE <sup>2</sup>	TRM 435	TRM 450	TRM 1051	TRM 1060	PYRAMAT <sup>3</sup>
<b>PHYSICAL</b>								
Mass Per Unit Area	ASTMD-6566	oz/yd <sup>2</sup>	MARV	8.0	10.0	14.0	14.0	14.0
Thickness	ASTM D-6525	in	MARV	0.35	0.50	0.40	0.60	0.50
Light Penetration (% Passing)	ASTM D-6567	%	MARV	40	20	5	40	25
Color	Visual	–	–	Green	Green	Tan	Green, Tan	Green, Tan
<b>MECHANICAL</b>								
Tensile Strength	ASTM D-6818	lb/ft	MARV	225 x 175	400 x 300	300 x 225	275 x 225	3,100 x 2,000
Tensile Elongation	ASTM D-6818	%	Maximum	50	50	85	40	55
Resiliency	ASTM D-6524	%	MARV	80	90	80	80	80
Flexibility	ASTM D-6575	in-lbs	Average	0.015	0.026	0.022	0.026	0.640
<b>DURABILITY</b>								
UV Resistance @ 1000 hours	ASTM D-4355	%	MARV	80	80	80	80	90 <sup>3</sup>
<b>PERFORMANCE</b>								
Shear Stress <sup>4</sup>	ASTM D-6460	lb/ft <sup>2</sup>	Maximum	5	8	8	8	12
Manning's "n" <sup>5</sup>	Calculated	–	Typical	0.025	0.025	0.026	0.026	0.021
Seedling Emergence <sup>6</sup>	ECTC Draft Method #4	in	Typical	–	3	–	–	–

**NOTES**

1. The property values listed are effective 2/01/2004 and are subject to change without notice.
2. MARV indicates minimum average roll value calculated as the typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance testing will exceed the value reported.
3. Value obtained after 3000 hours.
4. Maximum permissible shear stress has been obtained through vegetated testing programs featuring specific soil types, vegetation classes, flow conditions, and failure criteria. These conditions may not be relevant to every project nor are they replicated by other manufacturers. Please contact SI Geosolutions for further information.
5. Calculated as typical values from large-scale flexible channel lining test programs with a flow depth of 6 to 12 inches.
6. Calculated as average plant height obtained with tall fescue grass seed in sand 14 days after seeding.

# EROSION CONTROL/NONDEGRADABLE RECPs

Product Name	RECP Type [1]	Composition		Performance/Design Values		Index Properties		
				Slope Applications	Channel Applications	Thickness mm (in) ASTM D 6525	Tensile Strength kN/m (lb/ft) ASTM D 5035	UV Stability (% tensile retention) ASTM D 4355
				Recommended Maximum Slope (h:v)	Design Shear Stress [3] Pa (lb/ft <sup>2</sup> ) (vegetated)			
		Number of Nets	Net Type [2]	Matrix				

## Maccaferri Inc.

[www.maccaferri-usa.com](http://www.maccaferri-usa.com)

MacMat R6	TRM	NP	synthetic	geocomposite	1:2	NP	10.2 (0.4)	35 (2398)	stabilized
MacMat R8	TRM	NP	synthetic	geocomposite	1:2	NP	20.0 (0.8)	51 (3500)	stabilized

## North American Green Inc.

[www.nagreen.com](http://www.nagreen.com)

SC250 Vmax <sup>3</sup>	TRM	3	synthetic	straw/coconut	>1:1	478 (10)	18.29 (0.72)	7.28 x 10.19 (500 x 700)	100 [4]
P300	TRM	2	synthetic	polypropylene	>1:1	384 (8.0)	14.30 (0.56)	4.37 x 4.37 (300 x 300)	90
C350 Vmax3	TRM	3	synthetic	coconut	>1:1	574 (12)	16.36 (0.64)	9.47 x 13.13 (650 x 900)	86 [4]
P550 Vmax3	TRM	3	synthetic	polypropylene	>1:1	672 (14)	19.30 (0.76)	18.93 x 21.84 (1300 x 1500)	100 [4]

## Tenax Corp.

[www.tenaxus.com](http://www.tenaxus.com)

Multimat 100	TRM	3	synthetic	polypropylene	1:1	574 (12)	700 (17.8)	10 x 15 (685 x 1027)	85
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# EROSION CONTROL/NONDEGRADABLE RECPs

Product Name	RECP Type [1]	Composition			Performance/Design Values			Index Properties	
		Number of Nets	Net Type [2]	Matrix	Slope Applications		Channel Applications	Thickness mm (in) ASTM D 6525	Tensile Strength kN/m (lb/ft) ASTM D 5035
					Recommended Maximum Slope (h:v)	Design Shear Stress [3] Pa (lb/ft <sup>2</sup> ) (vegetated)			
									UV Stability (% tensile retention) ASTM D 4355

## Maccaferri Inc.

www.maccaferri-usa.com

MacMat R6	TRM	NP	synthetic	geocomposite	1:2	NP	10.2 (0.4)	35 (2398)	stabilized
MacMat R8	TRM	NP	synthetic	geocomposite	1:2	NP	20.0 (0.8)	51 (3500)	stabilized

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www.nagreen.com

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## Tenax Corp.

www.tenaxus.com

Multimat 100	TRM	3	synthetic	polypropylene	1:1	574 (12)	700 (17.8)	10 x 15 (685 x 1027)	85
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## **Appendix D**

### **Annual Inspection Checklists and Maintenance Standards for Drainage Facilities**

## ANNUAL INSPECTION FORM

### General

Dam Name: \_\_\_\_\_

Date of Inspection: \_\_\_\_\_

Owner's Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone No.: \_\_\_\_\_

Inspected by: \_\_\_\_\_

Weather: \_\_\_\_\_

### Reservoir Data

Reservoir Level at Time of Inspection: \_\_\_\_\_ (feet below dam crest)

Reservoir Inflow at Time of Inspection: \_\_\_\_\_ (cfs or gpm)

Reservoir Outflow at Time of Inspection: \_\_\_\_\_ (cfs or gpm)

### Condition of Dam

Crest: \_\_\_\_\_

\_\_\_\_\_  
(Check for: surface cracking, animal burrows, low areas, horizontal alignment, ruts, trees, brush)

Upstream Face: \_\_\_\_\_

\_\_\_\_\_  
(Check for: slumps, slides, scarps, sinkholes, animal burrows, slope protection, wave erosion, trees, brush)

Downstream Face: \_\_\_\_\_  
\_\_\_\_\_

*(Check for: wet areas [no flow], seepage [note location], slides, slumps, scarps, change in slope, animal burrows, erosion, unusual movement, trees, brush, water loving vegetation)*

**Spillway(s):**

- Earthen Channel; \_\_\_\_\_  
\_\_\_\_\_

*(Check for: slide, slump, scarp, erosion protection, vegetation, debris)*

- Concrete Lined Channel; \_\_\_\_\_  
\_\_\_\_\_

*(Examine: sidewalls, channel floor, approach area, weir, discharge area. Check for: alignment, movement, cracking, spalling, undermining, etc.)*

- Drop Inlet; \_\_\_\_\_  
\_\_\_\_\_

*(Examine: intake structure, trashrack, conduit, stilling basin)*

Outlet Works:(visible elements) \_\_\_\_\_  
\_\_\_\_\_

*(Examine: intake structure, trashrack, stilling basin, control mechanism, outlet pipe. Check for: seepage, undermining, erosion, corrosion)*

Maintenance Deficiencies: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Additional Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Sketch of Dam and Reservoir Site

## Inspection Checklists for Madsen Creek Water Quality and Flow Control Pond

Inspector: \_\_\_\_\_

Date: \_\_\_\_\_

Annual or Emergency Inspection (circle one)

Does the inspection follow a storm? \_\_\_\_\_

\*Inspect the outside of the pond embankment by walking the toe of the berm and physically inspect the following items:

Inspection Item	Yes/No	Comments/Description
Is the grass on downstream face of the pond greater than 8 inches high?		
Is litter/debris on the site?		
Is pond vegetation/debris interfering with pond discharge function?		
Does the Dam Crest (roadway berm) have ruts that indicate a change in design elevation of 444.7?		
Does the upstream and/or downstream face have slumps or abrupt grade changes that possibly indicate a compromise in integrity of the pond liner?		
Does the spillway channel have slumps or abrupt grade changes that possibly indicate a compromise in the TRM (Turf Reinforcement Mat) integrity?		
Are there any signs of failure (slumping) at the outfall pad?		
Are there any visible springs at the toe or downstream face of the pond?		
Is there any debris/litter in the catch basins?		

Inspection Item	Yes/No	Comments/Description
Is there any visible damage to the outlet or inlet of the pipe system?		
Is there any damage to the trashrack?		
Is there any damage to the debris cage?		
Are the access hatches to the catch basins in working condition?		
Are the ladders in the catch basins in working condition? (i.e., no rust)		
Are the sluice gates in working condition?		
Is the site access gate and lock damaged?		
Is Inlet 1 or Inlet 2 blocked with more than 6 inches of sediment?		
Does Cell 1 of the pond (Inlet area) have more than 12 inches of sediment?		
Is the grass-lined ditch (area between Inlet 1 and 2) filled with more than 6 inches of sediment?		
Are there any cracks or damage elements (face) of the baffle walls?		

NOTE: Each "YES" item to be addressed with either a subsequent inspection with an engineer and/or geotech and work order.

## SETTLEMENT/MOVEMENT MONITORING DATA

DAM NAME: \_\_\_\_\_

OWNER NAME: \_\_\_\_\_

SURVEY LOCATION/STATION NO. <sup>[1]</sup>	DATE	ELEVATION (ft)	TOTAL SETTLEMENT	LATERAL DISPLACEMENT AND DIRECTION	PERSONNEL
A2+50 (begin)					
A3+00					
A3+50					
A4+00					
A4+50					
A5+00					
A5+50					
A6+00					
A6+50					
A7+00					
A7+50					
A8+00					
A8+41.2 (spillway)					
A9+00					
A9+50.6 (end)					

[1] Sheet C11 in plan set, Appendix A for constructed berm elevations and station location.

## DATA FORM FOR SEEPAGE

DAM NAME: \_\_\_\_\_

OWNER NAME: \_\_\_\_\_

[illegible]

## OBSERVATION WELL DATA FORM

DAM NAME: \_\_\_\_\_

OWNER NAME: \_\_\_\_\_

[illegible]

Comments: \_\_\_\_\_

\*dry, write "DRY". If frozen, write "FROZEN".

<b>NO. 1 – DETENTION PONDS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Storage Area	Sediment accumulation	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
Inlet/Outlet Pipe.	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Emergency Overflow/Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil on the spillway.	Spillway restored to design standards.

**NO. 3 – DETENTION TANKS AND VAULTS**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 3 – DETENTION TANKS AND VAULTS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

**NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
FROP-T Section	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
Cleanout Gate	Damaged or missing	Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
		Cleanout gate is missing.	Replace cleanout gate.

<b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
		Cleanout gate is not watertight.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Orifice Plate	Damaged or missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/8-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

**NO. 5 – CATCH BASINS AND MANHOLES**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

**NO. 5 – CATCH BASINS AND MANHOLES**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $\frac{7}{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. <b>Any open structure requires urgent maintenance.</b>	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

<b>NO. 6 – CONVEYANCE PIPES AND DITCHES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

**NO. 7 – DEBRIS BARRIERS (E.G., TRASH RACKS)**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed.</b>
Site	Trash and debris	Trash or debris plugging more than 20% of the area of the barrier.	Barrier clear to receive capacity flow.
	Sediment accumulation	Sediment accumulation of greater than 20% of the area of the barrier	Barrier clear to receive capacity flow.
Structure	Cracked broken or loose	Structure which bars attached to is damaged - pipe is loose or cracked or concrete structure is cracked, broken or loose.	Structure barrier attached to is sound.
Bars	Bar spacing	Bar spacing exceeds 6 inches.	Bars have at most 6 inch spacing.
	Damaged or missing bars	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace barrier to design standards.

**NO. 8 – ENERGY DISSIPATERS**

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed.
Site	Trash and debris	Trash and/or debris accumulation.	Dissipater clear of trash and/or debris.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Rock Pad	Missing or moved Rock	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.	Rock pad prevents erosion.
Dispersion Trench	Pipe plugged with sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench).	Water discharges from feature by sheet flow.
	Perforations plugged.	Over 1/4 of perforations in pipe are plugged with debris or sediment.	Perforations freely discharge flow.
	Water flows out top of "distributor" catch basin.	Water flows out of distributor catch basin during any storm less than the design storm.	No flow discharges from distributor catch basin.
	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage.	All gabion mesh capable of containing rock and retaining designed form.
	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing rock	Any rock missing that could cause gabion to loose structural integrity.	No rock missing.
Manhole/Chamber	Worn or damaged post, baffles or side of chamber	Structure dissipating flow deteriorates to ¼ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure is in no danger of failing.
	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound.	Manhole/chamber is sealed and structurally sound.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No soil or water enters and no water discharges at the joint of inlet/outlet pipes.

<b>NO. 9 – FENCING</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Erosion or holes under fence	Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence.	No access under the fence.
Wood Posts, Boards and Cross Members	Missing or damaged parts	Missing or broken boards, post out of plumb by more than 6 inches or cross members broken	No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound.
	Weakened by rotting or insects	Any part showing structural deterioration due to rotting or insect damage	All parts of fence are structurally sound.
	Damaged or failed post foundation	Concrete or metal attachments deteriorated or unable to support posts.	Post foundation capable of supporting posts even in strong wind.
Metal Posts, Rails and Fabric	Damaged parts	Post out of plumb more than 6 inches.	Post plumb to within 1½ inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.

**NO. 10 – GATES/BOLLARDS/ACCESS BARRIERS**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Chain Link Fencing Gate	Damaged or missing members	Missing gate.	Gates in place.
		Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
		Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
		Missing stretcher bar, stretcher bands, and ties.	Stretcher bar, bands, and ties in place.
	Locking mechanism does not lock gate	Locking device missing, no-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.
Bar Gate	Damaged or missing cross bar	Cross bar does not swing open or closed, is missing or is bent to where it does not prevent vehicle access.	Cross bar swings fully open and closed and prevents vehicle access.
	Locking mechanism does not lock gate	Locking device missing, no-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Support post damaged	Support post does not hold cross bar up.	Cross bar held up preventing vehicle access into facility.
Bollards	Damaged or missing	Bollard broken, missing, does not fit into support hole or hinge broken or missing.	No access for motorized vehicles to get into facility.
	Does not lock	Locking assembly or lock missing or cannot be attached to lock bollard in place.	No access for motorized vehicles to get into facility.
Boulders	Dislodged	Boulders not located to prevent motorized vehicle access.	No access for motorized vehicles to get into facility.
	Circumvented	Motorized vehicles going around or between boulders.	No access for motorized vehicles to get into facility.

<b>NO. 11 – GROUNDS (LANDSCAPING)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. <b>A hazard tree identified by a qualified arborist must be removed as soon as possible.</b>	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.

## NO. 12 – ACCESS ROADS

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standards size garbage can).	Roadway drivable by maintenance vehicles.
		Debris which could damage vehicle tires or prohibit use of road.	Roadway drivable by maintenance vehicles.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Blocked roadway	Any obstruction which reduces clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
		Any obstruction restricting the access to a 10- to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width.	At least 12-foot of width on access road.
Road Surface	Erosion, settlement, potholes, soft spots, ruts	Any surface defect which hinders or prevents maintenance access.	Road drivable by maintenance vehicles.
	Vegetation on road surface	Trees or other vegetation prevent access to facility by maintenance vehicles.	Maintenance vehicles can access facility.
Shoulders and Ditches	Erosion	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.
Modular Grid Pavement	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damaged or missing	Access surface compacted because of broken or missing modular block.	Access road surface restored so road infiltrates.

## NO. 16 – WETPOND

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Site	Trash and debris	Any trash and debris accumulated on the wetpond site.	Wetpond site free of any trash or debris.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Side Slopes of Dam, Berm, internal berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm or embankment integrity, are not interfering with access or maintenance or leaves do not cause a plugging problem they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, internal berm or Embankment	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
	Irregular surface on internal berm	Top of berm not uniform and level.	Top of berm graded to design elevation.
Pond Areas	Sediment accumulation (except first wetpool cell)	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth.
	Sediment accumulation (first wetpool cell)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level (first wetpool cell)	First cell empty, doesn't hold water.	Water retained in first cell for most of the year.
	Algae mats (first wetpool cell)	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Emergency Overflow Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.

<b>NO. 16 – WETPOND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.

## **Appendix E**

### **Completed Annual Dam Safety Inspection Checklists**

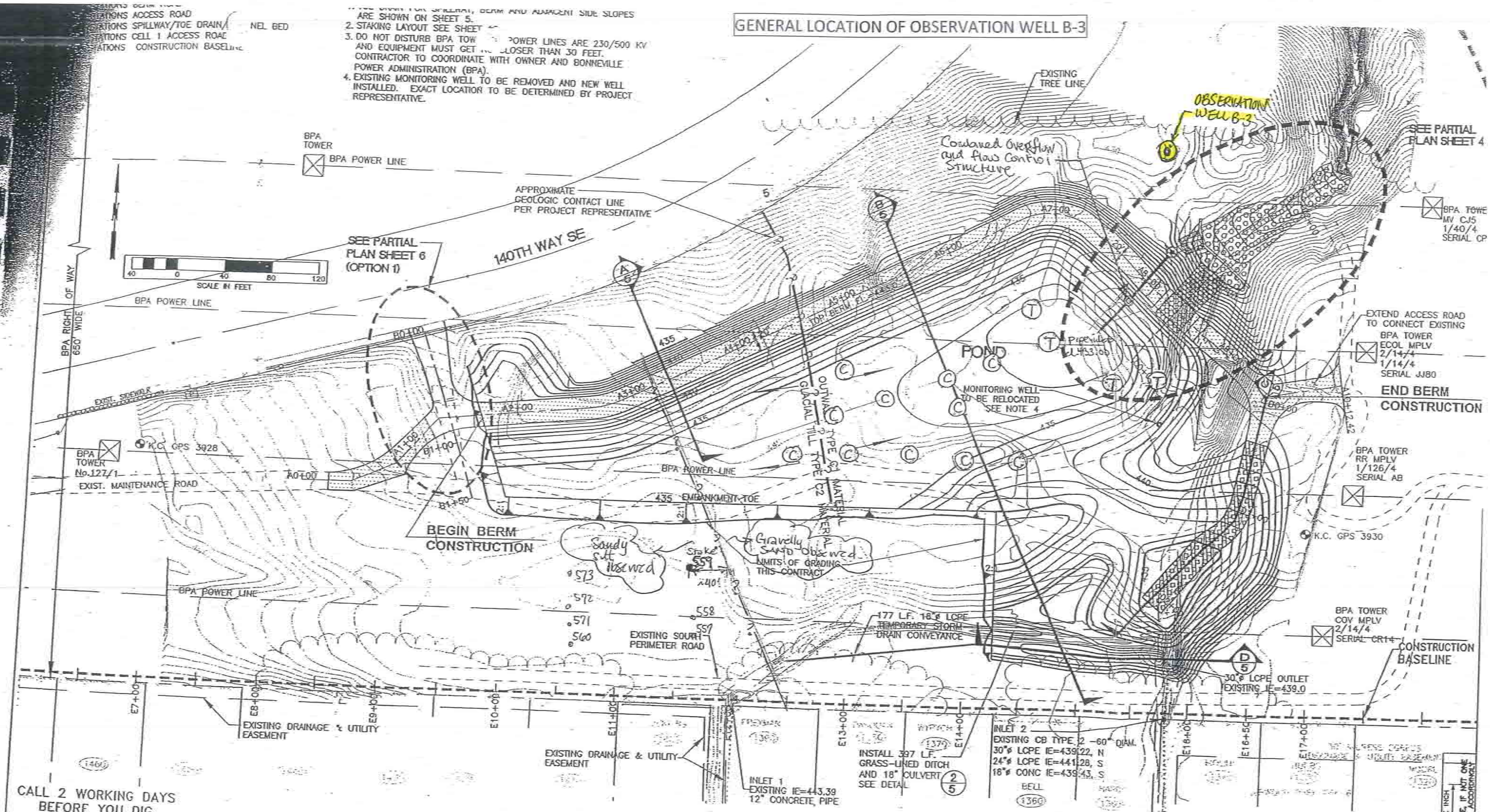
## **Appendix F**

### **Work Authorizations (Requests and Completed)**

## **Appendix G**

### **Observation Well B-3 Location and Construction Details**

# GENERAL LOCATION OF OBSERVATION WELL B-3



CALL 2 WORKING DAYS BEFORE YOU DIG  
 1-800-424-5555

## Legend

- ① Native till consisting of gray-brown, slightly gravelly to gravelly, silty sand observed at this location; upper 1/2" to 1" of desiccated soil (below pond liner) was shoveled away to expose firm, compacted, moist to dry till
- ② Imported, gray, clayey silt/silty clay observed at this location; upper 1 1/2" to 2" of desiccated soil (below pond liner) was shoveled away to expose, firm, moist clay

Madsen Creek Regional Detention Pond  
 Pond Liner Assessment and Observation  
 King County, Washington

SITE VISIT OBSERVATIONS

August 10, 2007  
 Shanon & Wilson, Inc.

# Approximate Latitude-Longitude of Observation Well B-3

Access trail to  
Observation  
Well B-3

Observation Well B-3

-122.1466833, 47.4592

Top of Bird Cage:  
Outlet Control Structure

-122.146783333, 47.45885



King County

25 12.5 0 25 50 75 100 Feet



# RESOURCE PROTECTION WELL REPORT

WELL TAG NO. AFM 780

START CARD NO. *R 41646*

PROJECT NAME: KC DNR Madsen Creek Detention

COUNTY. King 23-SF-224

WELL IDENTIFICATION NO. 2" monitoring well Pond

LOCATION NE  $\frac{1}{4}$  NE  $\frac{1}{4}$  Sec 22 Twn 23 N R 5E

DRILLING METHOD: Hollow Stem Auger

STREET ADDRESS OF WELL 1/4 mile N of Fairwood

DRILLER: Wade A. Betlaf

Bldg. on 140<sup>TH</sup> way SE

FIRM: Gregory Drilling Inc.

WATER LEVEL ELEVATION. *NA*

SIGNATURE: Wade L. Beal

GROUND SURFACE ELEVATION: *NA*

CONSULTING FIRM: *Shannon & Wilson*

INSTALLED 2-22-2001

REPRESENTATIVE: \_\_\_\_\_

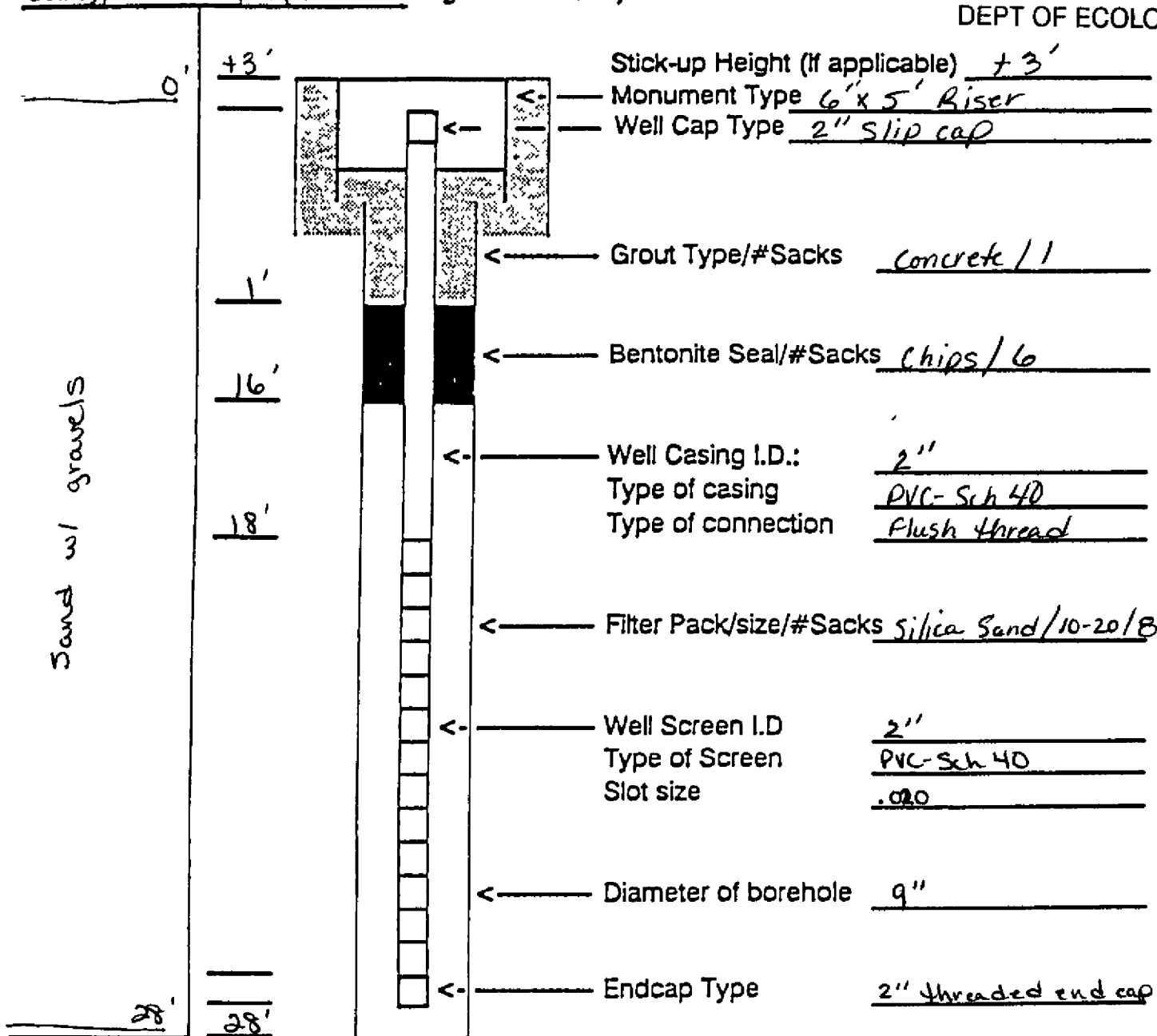
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~~RECEIVED~~

MAY 08 2001

[illegible]

DEPT OF ECOLOGY



Remarks:

94930

## **Appendix H**

### **Permits**



STATE OF WASHINGTON  
DEPARTMENT OF ECOLOGY

P.O. Box 47600 • Olympia, Washington 98504-7600  
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

July 13, 2001

**CERTIFIED MAIL**

Mr. Michael L. O'Neil  
King County Dept. of Natural Resources  
MS:KSC-NR-0510  
201 S. Jackson Street  
Seattle, WA 98104-3855

Dear Mr. O'Neil:

**RE: Coverage Under the Stormwater General Permit for Construction Activity**

**Permit Number: SO3-004325**

**Site Name: Madsen Creek West Basin Water Quality Improvement**  
**Location: 140<sup>th</sup> Way SE 400 ft N of SE 162 Pl**  
**Renton, WA**

The Washington Department of Ecology has reviewed your application for coverage under the Stormwater General Permit for construction activity for the subject site. We are granting coverage under the permit as of the date of this letter. *Retain this letter with your permit. It is the official record of permit coverage for your site.*

Note the permit number assigned for the above project. Refer to the permit number on any future correspondence with Ecology. Examples of the type of correspondence could be as follows: 1) If you wish to notify Ecology that there is a new 24-hour contact person for the project. 2) When certain phases have been stabilized or sold. 3) When the entire project has been sold. (The permit may be transferred to the new owner.) 4) When a new application and public notice is submitted requesting extended permit coverage for adjoining acreage. 5) When the site has been stabilized, submit a termination request form to cancel the permit and associated fees.

Please read the enclosed permit carefully. As a permittee, you are legally obligated to comply with its terms and conditions. An accompanying document called a Fact Sheet is available upon request by calling (360) 407-7156. The Fact Sheet helps explain the development process for the general stormwater permit.



Mr. Michael L. O'Neil

July 13, 2001

Page 2

### **Stormwater Pollution Prevention Plan (SWPPP)**

The most significant requirement of the general permit is the development, implementation, and maintenance (revision) of a Stormwater Pollution Prevention Plan for the entire duration of the project. Implement the SWPPP as the first step when starting construction. Plan requirements are given in Special Condition S9 of the permit. The purpose of the SWPPP is to reduce, eliminate, and prevent the pollution of stormwater through the application of Best Management Practices. Failure to prepare and implement an adequate SWPPP could result in violations of state and federal laws and regulations. Retain the SWPPP on or near your project. The SWPPP shall be made available upon request from Ecology or local government inspectors.

### **Permit Fees**

State law (RCW 90.48.465) requires that all permittees pay an annual permit fee. If your permit goes into effect during the State's fiscal year (June 30 – July 1), the initial fee will be prorated to the quarter. Future **yearly** billing notices will be mailed to you in August.

Permits that terminate during the State's fiscal year will have their fees prorated. Ecology will not process refunds if the ending balance of the fee account is **less than one hundred dollars (\$100)**.

If you would like more information on the fee process, contact Bev Poston, Fee Administrator, Department of Ecology at (360) 407-6425.

### **Appeal**

You, or a third party, may appeal Ecology decision to issue a general stormwater permit for your site. The appeal is limited to the general permit's applicability or non-applicability to your project, not the permit itself. An appeal may be filed with the Pollution Control Hearings Board, P.O. Box 40903, Olympia, WA 98504-0903 within thirty days from the effective date of your permit. In addition, a copy of the appeal must be served on the Department of Ecology, P.O. Box 47696, Olympia, WA 98504-7696. Enclosed is a copy of RCW 43.21B.310 that lists the procedures and requirements for the appeal process.

### **Notice of Termination**

After your site has undergone final stabilization, submit a Notice of Termination form (located in the back of the permit). Final stabilization is defined as follows. There are no bare soils remaining, the landscaping is well established, paving is complete, all temporary sediment and erosion control devices have been removed, and all stormwater discharges associated with

Mr. Michael L. O'Neil

July 13, 2001

Page 3

construction activities have been eliminated. **Permit fees continue until Ecology receives the completed termination form.**

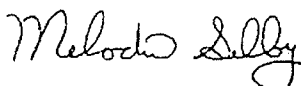
**Ecology Regional Assistance**

If you have questions regarding stormwater discharges for your construction site, select the county where your construction site is located and call the Ecology staff person assigned to that county:

NORTHWEST REGIONAL OFFICE IN BELLEVUE	
Bob Wright (425) 649-7060	Island, San Juan, Skagit, Whatcom
Sean Callahan (425) 649-7223	Snohomish and Kitsap
Ron Devitt (425) 649-7028	King County

Please call Linda Matlock at (360) 407-6437 if you have any questions regarding this letter.

Sincerely,



Melodie A. Selby, P.E., Manager  
Program Development Services  
Water Quality Program

Enclosures

cc: Ron Devitt, Ecology, NWRO



Willis Mansfield

January 6, 2009

Page 2

As required by State law (RCW 90.48.465), Ecology charges a fee for its discharge permits. Although your permit coverage is terminated you will receive a bill for the period of time the permit was effective.

If you would like more information on the fee process, please contact Bev Poston at 360-407-6425 or send email to [bpos461@ecy.wa.gov](mailto:bpos461@ecy.wa.gov).

If you have any questions regarding the termination process, please contact Megan Wisdom at 425-649-4483 or send email to [mwis461@ecy.wa.gov](mailto:mwis461@ecy.wa.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Bill Moore", with a stylized flourish at the end.

Bill Moore, P.E., Manager  
Program Development Services Section  
Water Quality Program

cc: Bev Poston, Ecology/Water Quality Program/Fees  
Megan Wisdom, Ecology/Water Quality Program



King County  
Department of Development and  
Environmental Services  
Land Use Services Section  
900 Oakesdale Avenue Southwest  
Renton, WA 98055-1219

Project No: L01CG192

Date: July 16, 2002

## REVISED GRADING/ CLEARING PERMIT

Permit Type: Grade

Title: Madsen Creek

Submitted: 4-23-01

Description: Phase 1: East tributary wetland outfall, mainstem high flow bypass modification and part 1 of the west basin water quality improvements (BPA pond). Phase 2: Restoration of Madsen Creek and the Northwest Tributary with boulders, logs and native vegetation. Phase 3: Completion of the BPA pond and the West Basin water quality improvements.

Date Issued: 9-17-01

Expires: 9-17-02

Applicant: King County DNR, ATTN: Bill Wilbert

Address: 201 South Jackson Street  
Seattle, WA 98104

Site Location: Parts of Sections 22, 23, and 27 of T23N R5E

Please refer to the above Project Number when making inquiries regarding this application. For Permit information or requests for inspections, call 206-296-6640.

### CERTIFICATION

I certify under penalty of perjury under the laws of the State of Washington that the information furnished by the owner or owner's agent in support of this application is true and correct. I further certify that all applicable King County requirements for the work authorized by this permit, if issued, will be met and that violation thereof will be cause for code enforcement action.

William Wilbert  
Owner /Applicant Signature

Real Property Agent  
Title

7-16-02  
Date

I have read the attached conditions of approval and understand that failure to comply with all conditions set forth herein shall necessitate an immediate work stoppage until such time as compliance with the stipulated conditions is attained. Failure to comply or repeated violations of permit conditions may result on enforcement actions, civil penalties as authorized under K.C.C. Title 23, and/or permit suspension or revocation. The granting of this permit shall not be construed as satisfying the requirements of other applicable Federal, State or Local government permits or regulations. The operation and maintenance of facilities authorized under this permit shall be conducted in accordance with the conditions contained herein and shall generally comply with all provisions of K.C.C. 16.28 and other applicable County Codes.

William Wilbert  
Owner /Applicant Signature

Real Property Agent  
Title

7-16-02  
Date



King County  
Department of Development and  
Environmental Services  
Land Use Services Section  
900 Oakesdale Avenue Southwest  
Renton, WA 98055-1219

Project No: L01CG192

Date: July 16, 2002

## REVISED GRADING PERMIT CONDITIONS

---

Permit Type: Grade

---

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Expires: 9-17-02

Site Location: Parts of Sections 22, 23 and 27 of T23N R5E

Applicant: King County DNR, ATTN: Bill Wilbert


Address: 201 South Jackson Street  
Seattle, WA 98104

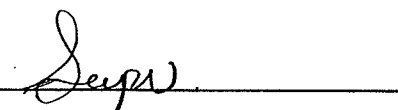
Phone No.: 206-296-7806

Other Information:

Please refer to the above Project Number when making inquiries regarding this application. For Permit information or requests for inspections, call 206-296-6640.

The conditions attached to this cover sheet apply to the permit referenced here. All conditions must be complied with by the contractor and verified by a Grading Inspector (Call 296-6640) or this permit will become null and void.

  
Reviewed By

  
Title

7-18-02  
Date

## **Conditions of Permit Approval Phase II**

### **Grading Permit #L01CG192**

The following conditions apply to the above referenced permit:

The permittee shall be responsible for all costs associated with the review and/or inspection of this permit by responsible department staff. These costs shall be in accordance with the fees set forth in King County Title 27. Failure to remain current with fee balances may be cause for suspension or revocation of the permit.

Development authorized by this permit or approval may require other state and/or federal permits, including, but not limited to, a Washington State Hydraulics Project Approval (HPA) or a U.S. Army Corps of Engineers 404 or Section 10 permit. If such other permit(s) is/are required, this/these other permits must be issued prior to issuance of this permit or approval. Failure to secure these other permits before beginning work authorized by this permit or approval is a violation of this condition, and may result in suspension or revocation of this permit/approval, and/or pursuing other enforcement actions. Should any other required permit be suspended, revoked or in anyway be subjected to other enforcement actions, this permit may be suspended until all defects causing said enforcement actions have been remedied. In addition, the granting of this permit or approval does not authorize the applicant to violate any provisions of the Endangered Species Act as set forth at 16 U.S.C. §§ 1531-1543, including the prohibition on the "take" of threatened or endangered species. "Take" is defined at 16 U.S.C. §§ 1532(19).

### **General Requirements**

- 5000 - At least 48 hours prior to the start of any work, call the Site Development Services Section to arrange a pre-construction meeting. Please be advised this permit shall not be effective until the Notice to Proceed has been issued pursuant to this meeting. If required, Notice of Construction Activity signs shall be in place prior to the pre-construction meeting.
- 5001 - Final construction of the pond under the BPA power lines shall not occur until a permit from the Washington State Department of Ecology for construction of a dam is submitted to DDES.
- 5005 - The boundaries of the clearing limits shown on this plan shall be clearly flagged in the field prior to construction. No clearing or grading shall take place until these limits are approved in the field by DDES staff. During the construction period, no

**Grading Permit #L01CG192**

Conditions of Permit Approval

7-15-02

Page 1 of 8

clearing (CDL) debris to be removed from the site shall be disposed of or recycled in an approved, legal disposal or recycling site. It will be the permittee's responsibility to locate acceptable disposal or recycling sites and to assure that all surplus material and CDL debris is disposed of in those sites.

- 5230 - Prior to bond release or closure of the permit, the permittee shall provide a detailed account of all off-site disposal activities. This accounting shall include date, number of trips, volume, haul route used, type of truck, type of material, and destination, with a complete summary for each separate disposal site.
- 5240 - If the contractor chooses to dispose of excess excavated material on sites where less than 100 cubic yards and 3 feet of fill will be placed, the contractor shall provide documentation that these sites have been inspected by a consultant capable of identifying sensitive areas as defined by King County Code. The report shall include date of inspection, name of consultant and company, an assessor's map of the parcel, the name, address and phone number of the property owner, and the location of the fill placed on the property. No fill shall be placed in sensitive areas or their buffers on these sites.

#### **Erosion Control Requirements**

- 5260 - Turbidity caused by construction activities from this project shall not exceed Washington State water quality standards. Sediment larger than 0.075 mm shall not leave the site or enter on site wetlands, streams, lakes or other natural drainage features or existing constructed drainage systems which outlet to natural drainage features.
- 5300 - If gravel is used to fill in the trench for keying in the filter fabric fence, rather than native backfill, the gravel shall be washed and clean.

days during the wet season (October 1 to March 31) or seven days during the dry season (April 1 to September 30) shall be immediately stabilized with approved TESC measures (e.g., seeding, mulching, plastic covering, etc.) If a King County Community Plan and/or Basin Plan or the Depart. of Ecology Stormwater Manual have more conservative timelines for implementation of erosion control measures, the more stringent timelines shall apply.

- 5385 - All surface water from disturbed areas shall be intercepted, conveyed to a sediment pond or trap, and discharged down slope of disturbed areas. An exception is for areas at the perimeter of the site with drainage areas small enough to be treated solely with perimeter protection. Surface water flows shall be intercepted concurrently with or immediately following rough grading.
- 5460 - Permittee shall be responsible for implementing all appropriate measures needed (i.e. paving, sweepers, and/or other techniques) to keep streets and roads used as haul routes for export or import of material clean and free from debris, mud, etc.
- 5475 - Warning signs must also be installed prior to hauling and must conform to the Manual on Uniform Traffic Control Devices.

#### **Sensitive Areas Requirements**

- 5502 - Water quality monitoring shall be performed in the manner described in the "Madsen Creek Construction Water Water Quality Monitoring Plan" dated July 2002.
- 5503 - If water is flowing at the time of instream work, flows shall be routed around the work site using gravity or pump bypass techniques so that the work area is isolated from flowing water. Sandbags shall not be used waterward of the Ordinary High Water Mark (OHWM). Bags filled with clean gravel may be used waterward of the OHWM.

- 5511 - The project must be completed in accordance with the approved plans approved 7-15-02 and project justification report dated July 2002. Field changes must be documented and approved by the project geologist. Written or e-mail notification of any field changes must be provided to the King County DDES Inspector.
- 5513 - A final report documenting as-built conditions and verifying that the project has been constructed in accordance with the approved plans and project justification shall be prepared and stamped by the project geologist.
- 5514 - A temporary ten foot buffer must be established from the top of the steep slope area. The edge of the buffer shall be marked prior to clearing or construction work. Clearing or trimming of vegetation within the 10 foot buffer and on the steep slopes must be minimized and any trees that are to be removed must be marked prior to the pre-construction meeting. All disturbed areas within the 10 foot slope buffer shall be restored as soon as practical and no later than 6 months following construction.
- 5516 - All work within the steep slope, the steep slope buffer, the ravine, alluvial fan and channel, must be supervised by the project geologist or qualified designee.
- 5518 - The work shall be monitored by the project geologist for a period of 10 years. Written inspection reports shall be provided after 1 year, 3 years, 5 years and 10 years, and after any flood, debris flow or landslide activity that mobilizes large material placed in the stream bed. Each inspection report must include an assessment of the relative debris flow hazard and the geomorphic conditions influencing that determination. Inspection reports shall be stamped by the project geologist and provided to the King County Inspector.



King County  
Department of Development and  
Environmental Services  
Land Use Services Section  
900 Oakesdale Avenue Southwest  
Renton, WA 98055-1219

Project No: L01CG192

Activity No: L04GI138

Date: August 9, 2004

## PERMIT EXTENSION APPROVAL

INSP.: RAIN

Permit Type: G-INSPCT

Sub Type: INSPGRAD

Title: MADSEN CRK STREAM RESTORATION

Submitted:

Description: Restoration along mainstream and trib. to Madsen Crk. Logs, boulders, and gravel will be used to create a diverse stream structure.

Date Issued: 08-09-04

Expires: 08-23-05

Site Location: Madsen Creek (S22,23,26+27-T23N-R05E)

Parcel No.: 231430 1000

Applicant: KCDNR/WTD/Bill Wilbert

Owner's Name: King County

Address: 201 S Jackson St/MS: KSC-NR-0600  
Seattle, WA 98104

Address:

Phone No.: 206-296-7806

Phone No.:

Other Information:

Please refer to the above project number when making inquiries regarding this extension. For Permit information or requests for inspections, call your Grading/Clearing Inspector at 206-296-7142

The above referenced project has been approved for issuance of a one year (1) extension. All conditions attached to this project and its associated activities, if any, must be complied with by the contractor and verified by your Grading/Clearing Inspector or this permit will become null and void.

Approved By

Title

Date



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000

TTY 711 or 800-833-6388 (For the Speech or Hearing Impaired)

May 6, 2005

Ms. Rachael J. Berryessa  
Project Manager, SWES Unit  
King County Water & Land Resources Program  
King Street Center  
201 South Jackson Street, Suite 600  
Seattle, WA 98104-3855

Project: Madsen Creek West Basin Dam  
File No.: KI08-1862

Dear Ms. Berryessa:

The final plans and specifications for the revised Madsen Creek West Basin Dam have been reviewed, and the issues raised in our previous correspondence have been addressed. The plan review and construction inspection fee has already been submitted for the previous design of the project, so no further fees are required. Finally the Construction Inspection Plan has been received and is acceptable. **Therefore, the plans and specifications for this project are hereby approved.** Enclosed is one set of the approved plans and specifications, and a Dam Construction Permit to be posted at the construction site.

This approval is limited to the elements of the plans and specifications directly related to the construction of the dam. If significant change orders are required to meet changed field conditions, those changes should be coordinated and approved by our office.

Periodically during construction, engineers from the Dam Safety Office will be on site to observe construction activities. To facilitate inspection scheduling, it is required that the DSO be kept informed of construction progress. To this end, please provide us with a copy of the construction schedule when it becomes available. We should also be invited to the preconstruction meeting with your contractor and the project engineer.

To complete the Dam Safety Construction Process, the following activities must be performed.

- The Operation and Maintenance (O&M) Plan for the project must be finalized. The Plan must be submitted to the DSO for review and acceptance before the authorization to commence project operation is issued. Information on the development of O&M Plans is contained in Ecology Publication Number 92-21, *Guidelines for Developing Dam Operation and Maintenance Plans*.

Madsen Creek West Basin Dam

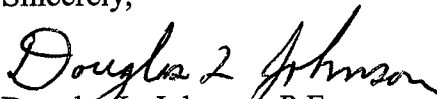
May 6, 2005

Page 2

- An Emergency Action Plan must be prepared for this facility, and approved by the Dam Safety Office prior to completion of construction. Information on the development of EAPs is contained in Ecology Publication Number 92-22, *Guidelines for Developing Dam Emergency Action Plans*.
- Within 30 days following substantial completion of construction, the project engineer shall submit to the DSO a declaration stating that the project was constructed in accordance with the department approved plans and specifications and construction change orders (if any). Following concurrence with the project engineer's declaration, and acceptance of the O&M Plan and EAP, the Dam Safety Office will authorize the project to begin operations.

I look forward to working with you to complete the construction of this project. Should you have any questions on the foregoing, please call me at (360) 407-6623, or Gustavo Ordonez at (360) 407-6619.

Sincerely,



Douglas L. Johnson, P.E.  
Supervisor, Dam Safety Office  
Water Resources Program

# PERMIT FOR DAM CONSTRUCTION

IN ACCORDANCE WITH RCW 90.03.350 & WAC 173-175-180

PROJECT: BPA Madsen Creek West Basin PERMIT NO: 1862-04

DAM OWNER: King County DNRP



ISSUED BY THE DEPARTMENT OF ECOLOGY  
DAM SAFETY OFFICE  
WATER RESOURCES PROGRAM

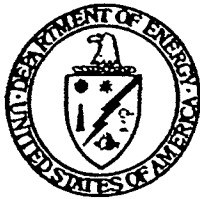
DATE: 7/30/04

APPROVED BY: Douglas Johnson

TO BE POSTED IN A PROMINENT LOCATION AT SITE

## **Appendix I**

### **Permanent Easements and Agreements**



**Department of Energy**  
Bonneville Power Administration  
28401 Covington Way SE  
Kent, WA 98290

May 1, 2001

In reply refer to: Case No. 010079

Tract ID: R-MV-475

Lines: Raver-Maple Valley No 1 & 2  
(Operated as Echo Lake-Maple Valley No 1 & 2  
Maple Valley Loop South Line  
(Operated as C-MV No 2  
Maple Valley Loop North Line  
(Operated as Sammamish-Maple Valley No 1)  
Rocky Reach-Maple Valley No 1

CERTIFIED - RETURN RECEIPT REQUESTED

William Wilbert  
King County Department of Natural Resources  
201 So. Jackson Street, Suite 600  
Seattle, WA 98104-3855

### LAND USE AGREEMENT

#### SUPPLEMENT No. 1

The Bonneville Power Administration (BPA) Engineers have reviewed the plans you submitted and issued a Land Use Agreement (LUA) #010079 on December 20, 2000. Pursuant to your request, BPA is hereby modifying the LUA as follows:

#### BPA'S AGREEMENT IS CONTINGENT ON THE FOLLOWING CONDITIONS:

1. Install a gravity sewer pipeline as shown on Exhibit "A" to feed into the drainage pond.
2. Restrict the height of the planting for the project on the BPA, Right-of-Way (ROW) to a maximum of 10 feet in height. Some of the proposed native species listed on the Addendum to Environmental Checklist paragraph "B", item #4 subparagraph (2) i.e. big leaf maple, Douglas fir, Grand fir, Western white pine, and dogwood may not be advisable. If King County wishes to plant species that may obtain a height of 10 feet or more they would be required to take out a Tree and Brush Agreement prior to any plantings, and maintain the project plantings according. BPA reserves the right to

cut and or remove the plantings at anytime if such agreement is not maintained.

3. In addition, the berm at this site can be addressed at the time of construction by calling Clint Bostwick, Right-of-Way Specialist at (253)631-9154. BPA needs to insure the location of the berm, and the ground to conductor clearances can be met at the desired location prior to construction.
4. BPA will be allowed to use the newly constructed access road off of 140<sup>th</sup>, and around the pond as our access while on the ROW. (see Exhibit "A")

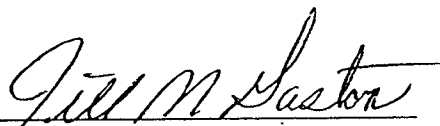
**ALL OTHER TERMS AND CONDITIONS FROM THE PREVIOUS AGREEMENT REMAIN THE SAME**

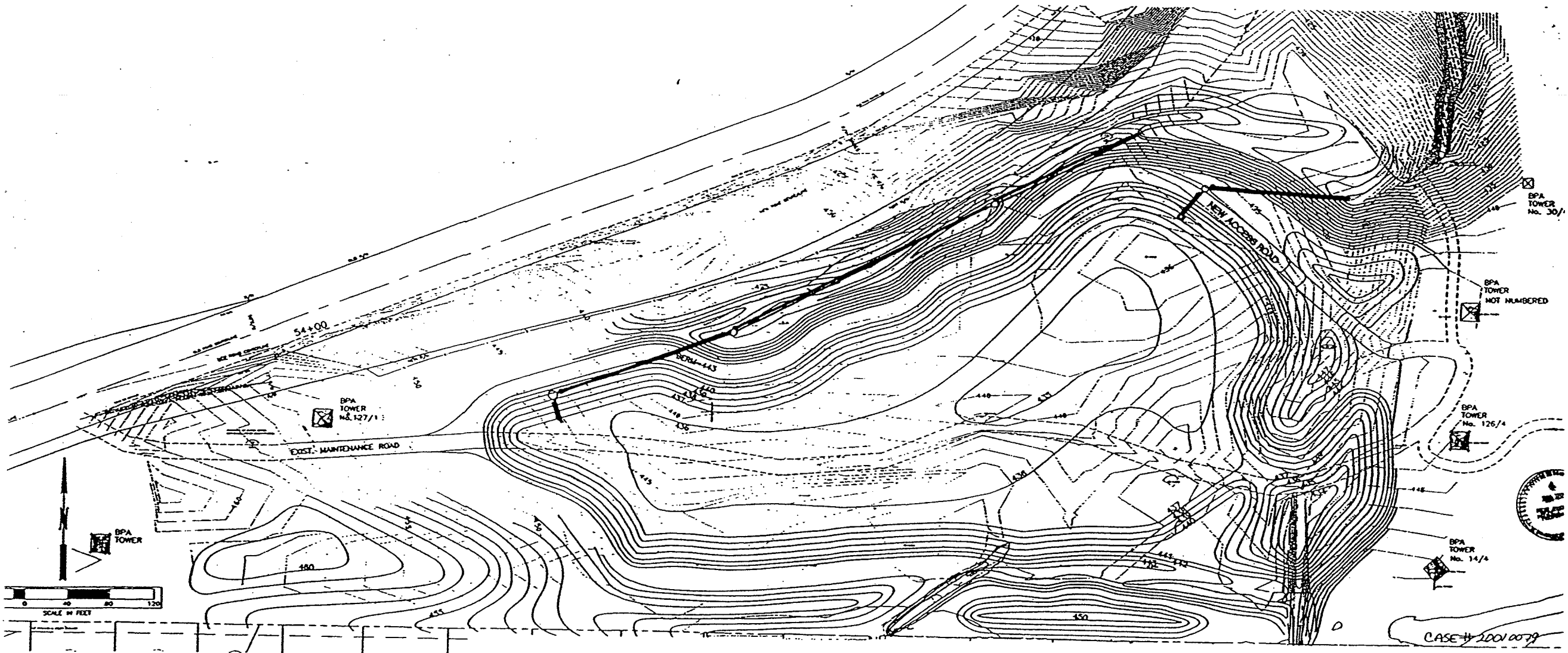
PLEASE NOTE: BPA is not the owner of this property, if you are not the owner, you must obtain the owner(s) permission to use this property. There may also be other uses of the Property, which might be located within the same area as your project. This agreement is subject to those other rights.

**IF WE DO NOT HEAR FROM YOU WITHIN 30 DAYS FROM THE RECEIPT OF THE AGREEMENT, THE TERMS OF THE AGREEMENT WILL BE ASSUMED TO BE ACCEPTABLE. THE AGREEMENT WILL THEN BECOME A PART OF OUR PERMANENT FILE AND MAPPING SYSTEM.**

You may direct any communication to this office, at the address listed above, or by telephoning me at (253)631-9154.

THIS AGREEMENT IS HEREBY AUTHORIZED

  
Jill M. Gaston  
Realty Specialist



**Exhibit A**